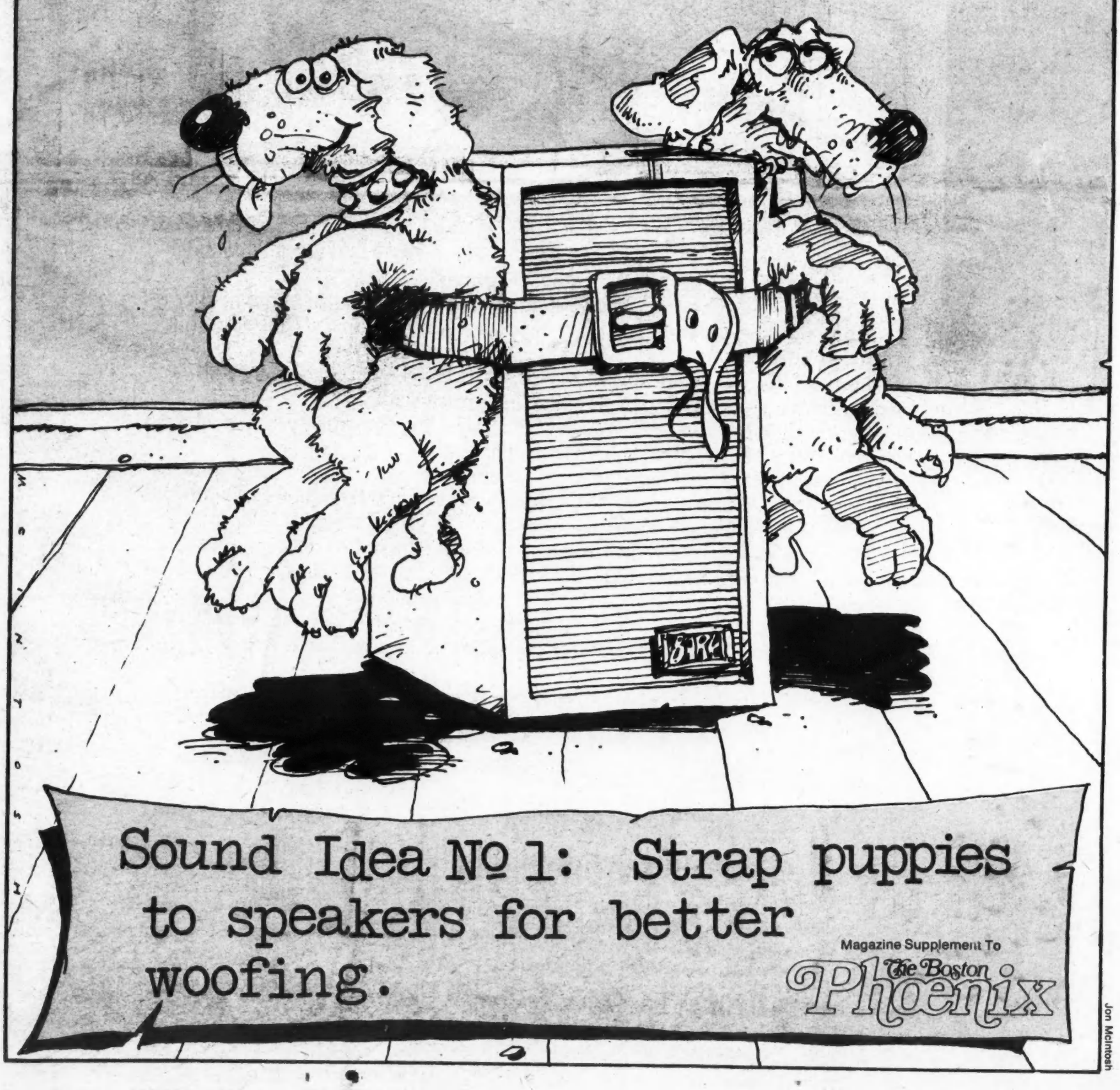
SOUND IDEAS:

WHY KLOSS LEFT ADVENT • CIZEK'S VARIABLE Q • TIME DELAY AND JOEL COHEN • A MATTER OF STYLE

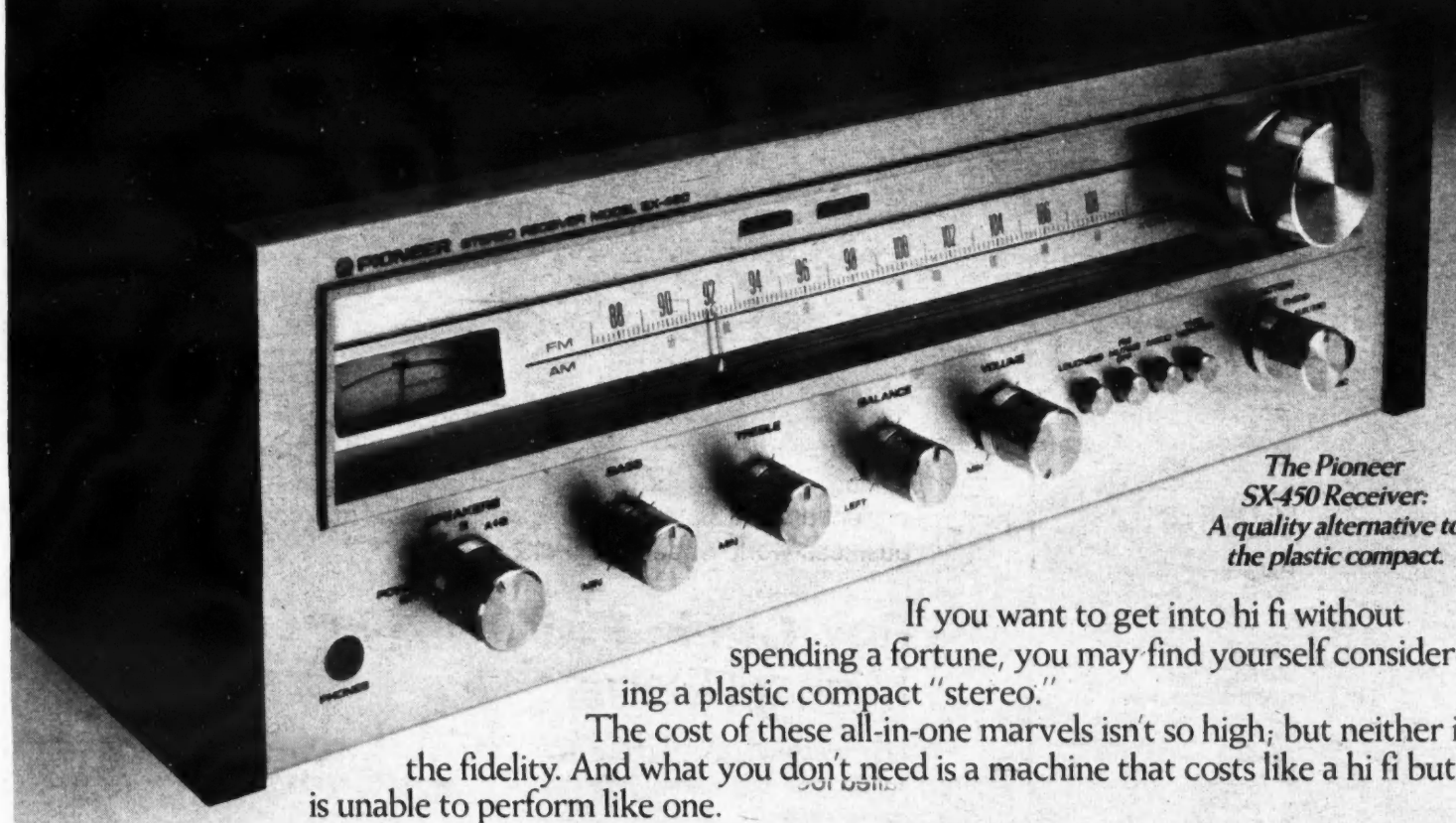


Sound Idea No 1: Strap puppies to speakers for better woofing.

Magazine Supplement To
The Boston Phoenix

Jon McIntosh

HIGH FIDELITY FOR THE PRICE OF MEDIOCRE FIDELITY.



The Pioneer SX-450 Receiver: A quality alternative to the plastic compact.

If you want to get into hi fi without spending a fortune, you may find yourself considering a plastic compact "stereo."

The cost of these all-in-one marvels isn't so high; but neither is the fidelity. And what you don't need is a machine that costs like a hi fi but is unable to perform like one.

Now there's an alternative: the new Pioneer SX-450, a high fidelity receiver with features and specifications unequaled by anything in its price class.

Since its price class is under $200,* you can assemble a fine high fidelity system around it for hardly more than a flimsy plastic compact would cost.

What qualifies the SX-450 as high fidelity is a continuous power output of 15 watts per channel, min. RMS, at 8 ohms, over the frequency range of 20 to 20,000 Hz, with no more than 0.5% total harmonic distortion.

It also has separate controls for bass, treble, balance, loudness, FM muting, mono/stereo and tape monitoring, plus a combined AM/FM tuning meter, a selector for two pairs of speaker systems, and jacks for headphones and microphone.

But you really have to hear the SX-450 to judge it. Ask a high fidelity dealer to hook one up to a pair of speakers and a turntable for you; don't be surprised at its richness, brilliance and accuracy.

After all, the SX-450 is as fine a high fidelity component as any receiver we make.

Even though you can have it for the price of something mediocre.

PIONEER®

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*For informational purposes only, the SX-450 is priced under $200. The actual resale price will be set by the individual Pioneer dealer at his option.

U.S. Pioneer Electronics Corp., 75 Oxford Drive, Moonachie, New Jersey 07074.

The following is a list of authorized Pioneer Dealers:

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Impulse
Value House

Boston
Atlantis Sound
Copley Camera
Lafayette Radio
Music Center of Boston
Tech HiFi
Tweeter, Etc.

Brockton
Tweeter, Etc.
S&E Audio
Persson Radio

Burlington
Lafayette Radio
Value House
Eardrum

Cambridge
Atlantis Sound
Lechmere Sales
Tech HiFi
Tweeter, Etc.
A. Smith Div. of Wolf & Smith
Eardrum

Chelmsford
Radio Shack

Cheetnut Hill
Tweeter, Etc.

Cohasset
Olde Colony Stereo

Danvers
Lechmere Sales
Lafayette Radio

Dartmouth
Pina Audio

Dedham
Lechmere Sales
Tape Place
Tech HiFi

Falmouth
Harmony Hut
Ortin's Photo

Fitchburg
Fitchburg Music

Framingham
Atlantis Sound
Tech HiFi

Hanover
Olde Colony Stereo
Quantum Sound

Haverhill
Value House

Lawrence
Malco Electronics
Lafayette Radio

Leominster
Electronic Werld

Nantucket
Grey Electronics

Natick
Lafayette Radio

Needham
You-Do-It

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Peabody
Atlantis Sound

Quincy
Olde Colony Stereo
Standard TV

Raynham
David B. Dean Co.

Salem
Highland Sales

Saugus
Lafayette Radio
Tech HiFi

Stoneham
Tech HiFi

Waltham
Tech HiFi
Waltham Camera

Watertown
K&L Sound

W. Bridgewater
Tape Place II

West Roxbury
Lafayette Radio

Weymouth
Suburban T.V.

Worcester
Atlantis Sound
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NEW HAMPSHIRE

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Radio Shack

Concord
Lafayette Radio

Dover
Radio Shack

Exeter
Charles J. Haley Inc.

Hanover
Dartmouth Audio

Keene
Melody Shop
Radio Shack/Hew

Laconia
Inner Ear

Salem
Radio Shack

Seabrook
Radio Shack

Manchester
Lafayette Radio
Bi-Rite Mdsers

Nashua
Tech HiFi

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Lafayette Radio

Portsmouth
Radio Shack

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Delta HiFi

Providence
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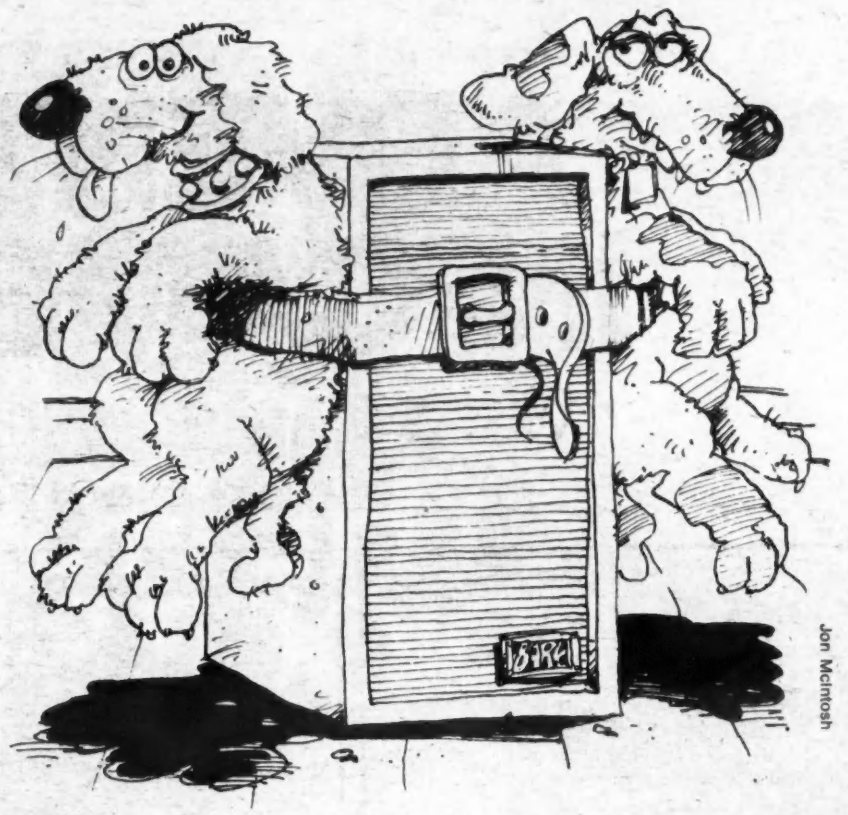
Apex
Tech HiFi
Impulse
Twin City Music House

Warwick
Tech HiFi
Apex
Impulse
Lafayette Radio

Woonsocket
Ed's TV

W. Warwick
Joe's Stereo

Westerly
Lafayette Radio



Jon McIntosh

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Paula Span

Less than two weeks ago, Henry Kloss resigned his position at the Cambridge corporation he founded in 1967. But the story behind the Kloss resignation dates back to the fall of 1975, when Advent, having overextended its bank's patience with Kloss's VideoBeam project and a $3 million deficit, was saved from corporate death by business-world super-star Peter Sprague.

Roy Cizek: Flatly Stated 6
Michael Matza

An interview with the founder of Cizek Audio Systems, and a detailed look at his new loudspeaker — its flat-impedance drivers and its variable Q.

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Phil Bertoni

A talk and a listen with one of the Boston area's two major innovators in the blossoming world of time delay. Joel Cohen is not your average engineer. Everyone in his family is an artist — except his father, who sells insurance.

For The Record 15
William Manning

Arnold Schwartz operates his company, Micro Acoustics, from faraway suburban Westchester County, New York. He's notable, but seldom noted, for setting the industry standard for cartridge calibration when he developed the CBS Test Record Series — not much to dance to, but invaluable, nonetheless.

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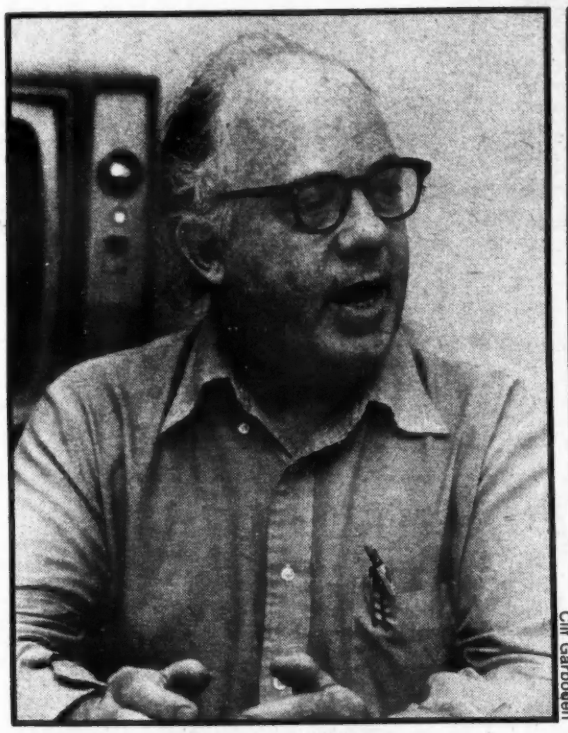
Jim Michmerhuizen

Jim Michmerhuizen is now the director of the Boston School of Electronic Music, but at our request he's looked into his own back pages to his early days as a hi-fi salesman when he first noticed a correlation between audio consumers and their systems.

Our thanks to local experts and all-around bright people Peter Mitchell, Carl Strathmeyer and Larry Nile for their help with some of the technical editing in this section.

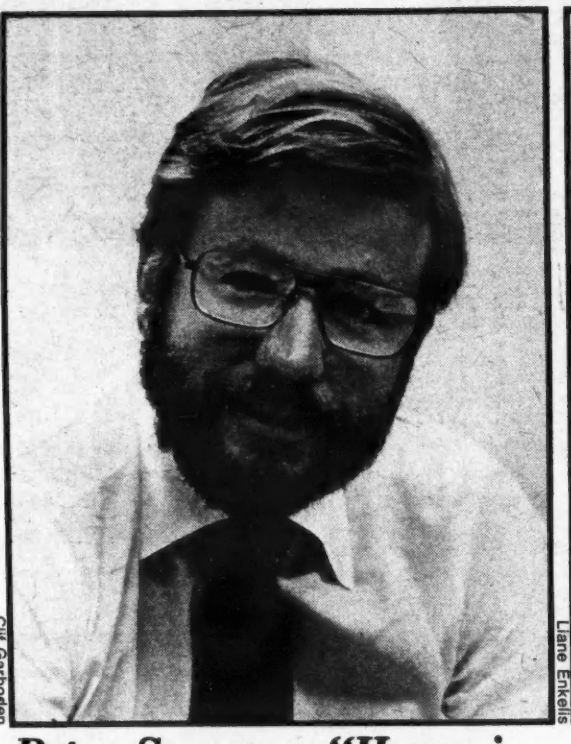
ADVENTURES IN CAMBRIDGE

Was Advent's Henry Kloss a victim of the businessman's crunch?



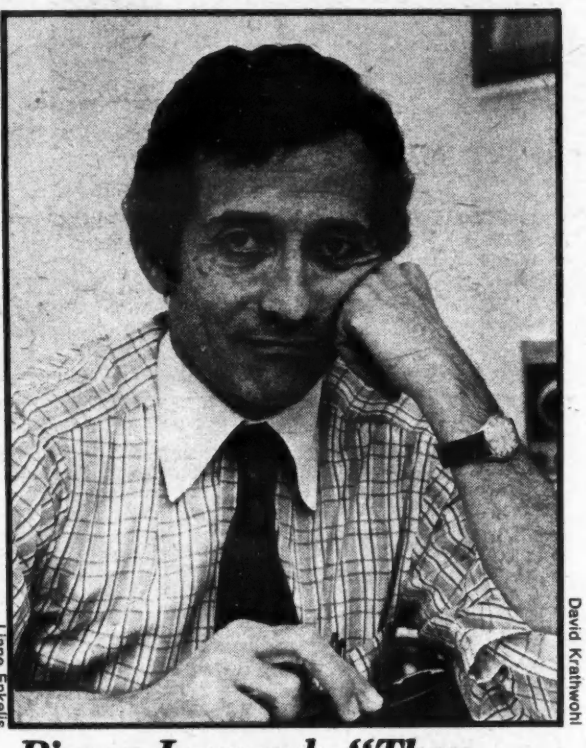
Cliff Garboden

Henry Kloss: "You can't continue to promulgate the idea that there's something magical about management. Management doesn't make money, product makes money."



Liane Enkelis

Peter Sprague: "Henry is not the world's best manager . . . . That's why I asked for the voting trust, so that I could run the company in my way, not in Henry's way."



David Krathwohl

Pierre Lamond: "They didn't know what the VideoBeam was actually costing, or if they knew, they ignored it, and went along selling it for less than it was costing."

by Paula Span

Ten days ago, the Advent Corporation issued a terse press release that read, "Pierre R. Lamond, President of Advent Corporation, announced today that Henry E. Kloss, Advent's Director of Research and Development, has resigned his position . . . . Mr. Kloss, the founder of Advent Corporation, will remain a member of the Board of Directors."

A day before, Kloss had cleaned out his office (the bottom papers were four years old), handed his resignation letter to Lamond and, without goodbyes, left the company. There was no triggering incident, Kloss said when he called the Phoenix *with the news. His resignation was the result of "an accretion of things." He had no plans, no other job. "I'm at home," he said, "starting to think."*

Henry Kloss's office at Advent Corporation in Cambridgeport was even messier than usual the last week of September — stacks of plans and drawings covered every surface; lenses, speaker parts and cathode ray tubes sat piled on chairs and window sills. During the past months, as his control of the company he created had drained away, rumors of Kloss's leaving Advent had grown in frequency and specificity. The latest round of gossip had even defined the date of his resignation and his new place of employment — Polaroid. It wasn't true, but Kloss had no intention of triggering more rumors by cleaning out his office.

The speculation was understandable. Henry Kloss and a loyal cadre of associates had built Advent in the late '60s. It successfully marketed innovative, high-quality audio components and it gave a number of bright people an exciting and congenial place to work. It was on the verge of introducing what Kloss calls the first significant improvement in television since color was introduced 20 years ago — near-life-size projection TV — when its troubles began.

The financial strain of developing the VideoBeam TV nearly smothered the small company. Last summer, to stave off bankruptcy, Kloss, then Advent's president, chairman of the board and largest stockholder, agreed to sell a large chunk of stock to a wealthy outside investor. After that decision, Kloss was quickly and unceremoniously stripped of authority and position, his team began to split up, and he made no secret of his bitterness.

The principals in this saga were at last month's annual meeting, all looking their parts: the rotund Kloss in his usual ensemble of chinos and Hush Puppies, for this occasion adding a red tie so skinny it had to date to 1961; Pierre Lamond, who replaced him as Advent's president, trim and coolly businesslike in a suit and styled hair; Peter Sprague, whose investment brought all these changes to Advent, a blond, bearded, pipe-puffing maverick 10 years their junior, whose attire combined a white monogramed shirt and a batik tie.

If Advent Corporation were a luncheonette, there'd be a banner hung in the front window — "Under New Management." The local tendency is to view the takeover as the Greedy Capitalists in Business Suits pitilessly driving out the Creative Boys in Adidas, which is nonsense. True, the company has changed in ways Kloss and company hadn't intended or expected. But without new investment, Advent might not have survived at all.

"Could it have been done another way?" the deposed president mused. "We'll let them write the case over at the [Harvard] Business School on that, shall we?" Until the business schools get around to it, this

Continued on page 29

David Krathwohl

The VideoBeam assembly line at Advent

TURN IT UP.

Don't buy any loudspeaker until you test drive it. You're not going to a recital. You're choosing a roommate.

Challenge it. Put it through its paces. Most loudspeakers can handle midrange, mid-volume, mid-mid sound. That's no test.

Turn it up! Really loud.

How does it sound? Do you like it? Is it clean? Is it clear? Does it splatter? Is it fuzzy or distorted?

Loudness magnifies the imperfections that will scar your subconscious at regular listening levels. Loudness tells you what time will do to your ears, your head, your disposition. Now:

TURN IT DOWN.

Way down. Take it to the edge of silence, and then come back a little.

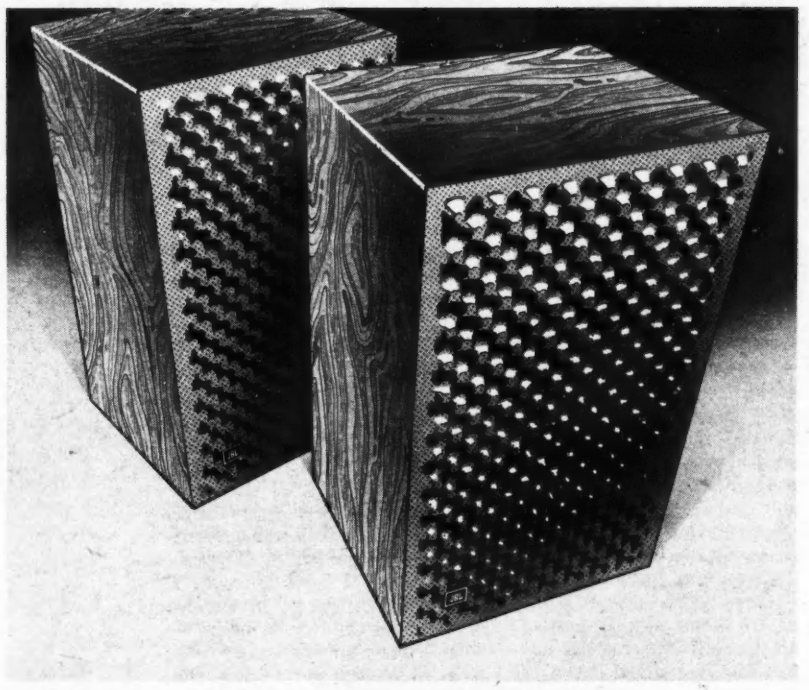
Can you hear every part of the music? Are all the textures and detail and harmonics of the music still there, or is only the melody lingering on?

Nobody wants to live with a loudspeaker that can't make its point unless it yells. So. Turn it down.

One last thought: You shouldn't have to judge a loudspeaker while you're listening to three other speakers, six other conversations and a partridge in a pear tree.

If you're serious about sound, find someone who's serious about helping you. Find a dealer with proper demonstration facilities. That's easy.

If it says "Authorized JBL Dealer," relax, friend. You've come to the right place.



JBL's new L166. The most accurate loudspeaker JBL has ever made. It's like nothing you've ever heard before. Nothing. $399 each.

JBL

High fidelity loudspeakers from $168 to $3510.

Now that you know how, here's where:

Tech Hi Fi
All locations except
Bargain Centers

MASSACHUSETTS
Boston
Copley Camera and Stereo
480 Boylston Street

Brockton
Tweeter Etc.
849 Belmont Street

Fitchburg
Fitchburg Music
175 Main Street

Hyannis
Nantucket Sound
Cape Cod Mall

Waltham
Waltham Camera & Stereo
367 Moody Street

RHODE ISLAND
Providence
Audionics
790 North Main Street

Woonsocket
The Listening Post
1300 Park Avenue

ROY CIZEK

Flatly stated, his "secret" is all in the cross-over

by Michael Matza

Stevie Wonder, Jose Feliciano, Brownie McGhee; the list of blind musical geniuses is a long one. Somehow the senses compensate, according to one explanation: what the eyes can't see is made up for by aural acuity. The world is processed not by its blurs but by its blips and bleeps — its rhythms. Seeing is just hearing — to an ear. It is the speed of sound not the speed of light that's the coefficient by which all experience is multiplied, and the result has produced some of the most sensitively rendered music we have, composed and performed by sightless visionaries.

Yet Roy Cizek, president of Cizek Audio Systems, his own newly formed audio loudspeaker company, will have none of these fancy explanations. Blind since early childhood, Roy took his first steps toward creating sound at age six, with a trumpet he was given by his father. He began studying music in earnest a few years later, and by adolescence — commencing with a three-tube radio he built from a kit at age 13 — he combined those logical partners, music and electronics. There'll be no "ears make up for eyes" explanations here: vigorous curiosity and uncommon inventiveness seem to do more to explain his success.

At the University of Indiana he pursued his affinity for music as a trumpet and piano major and third chair in the Philharmonic. Though a high school aptitude test had advised against a career in electronics (a finding Roy questions to this day) Cizek began building speakers and turned out his first professional-quality unit while still a junior at Indiana.

By 1964 he had opened a hi-fi store in Bloomington, Indiana. With the help of an English physicist who wandered into the store one day, Cizek developed what became his own house brand, "the best parts of a lot of different speakers," cannibalized and re-fashioned in hopes of producing a whole that was more than the sum of its parts.

Roy brought to his early designs the kind of exuberance a kid brings to tearing apart an alarm clock, and added to this the sophistication and laboratory accuracy of a skilled technician.

"We had actually torn apart an awful lot of speakers, just to find out about other companies' principles of design," Roy says.

Within a year after the store opened, Roy bought his first piece of audio test equipment and began running comparisons on every speaker he could lay his hands on. Not a woofer or tweeter was spared his scrutiny, and with each new discovery, he felt he was coming closer to an ideal which had become his obsession — a speaker that would produce in the home (as accurately as possible) that elusive quirk, "true concert-hall realism."

When he tested the top-of-the-line speaker of a well-known manufacturer and felt that, for all his successive improvements, he hadn't begun to match the sophistication of their technology, he had a friend make a bonfire of a dozen of his earlier creations. It was a moment of Dr. Frankenstein frustration, but the mad scientist in Cizek would not be stifled for long. He soon began building again.

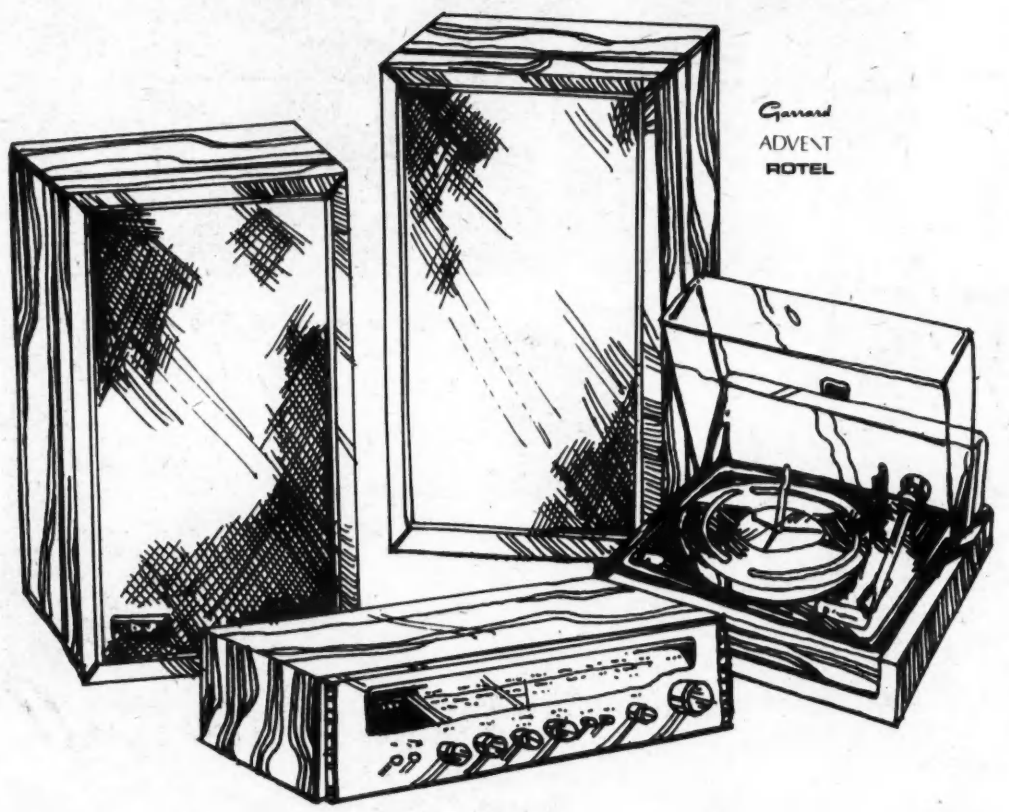
"It really became just a reckless, driving effort to see how good a speaker I could build. We went 24 hours a day for months, testing and building, until in May of '65 we finally came up

Continued on page 10

"In any speaker that utilizes a single woofer and a single tweeter, the key is the cross-over network. Most speakers simply do not produce a flat response."

The Tweeter, Etc. Story: Part 1

We At Tweeter Etc. Would Like To Introduce You To Quality Component Stereo



Tweeter, Etc.'s $299 system consists of a pair of Advent/3 loudspeakers, a Rotel RX-102 Mark II AM/FM receiver, and a Garrard 440M record changer. Complete: **$299.**

Introduction:

This is our first ad, one of a series designed to acquaint you with ourselves, and the field of component stereo.

We're running this series because we want to point out some of the things you should know before you go shopping for a stereo, as well as give you an idea of the kind of performance you can expect in the various price ranges.

We hope you enjoy the series.

First, We Want to Introduce Ourselves . . . .

Tweeter, Etc. is a stereo specialty store run by Michael and Sandy Bloomberg.

By stereo specialty store, we mean component stereo is our whole business.

We exist because we can sell you a better music system than anyone else in town.

This is partly due to the caliber of equipment we display. We specialize in names like Advent, ADS, Yamaha, Nakamichi, Allison, Tandberg, Sony, Phase Linear, Bang & Olufsen, JBL, and Pioneer. These names represent the best of what's available today.

We Offer Our Own Service....

Another reason we can sell you a better stereo is the excellence of our Service Department, headed by Charlie Gale.

We're factory-authorized to repair most everything we sell.

You Can Get Started In Quality Component Stereo For $299!

Although you can spend thousands of dollars on a stereo system at Tweeter, Etc., we're proud of the fact that you can take home a very fine system for less than three hundred dollars.

We're talking about our new Advent/3 system.

In contrast to the look-alike speakers sold by department stores and discount houses, the speakers used in our Advent/3 system are **real speakers.** They were designed by the same Henry Kloss who designed the famous Large Advent — the best-selling speaker in America today.

Speakers directly influence the sound quality of a stereo system more than any other component. We're proud to be able to offer true Advent speakers in our $299 package!

You Can Hear The Difference!

Our Advent/3 system is completed by the Rotel RX-102 Mark II AM/FM receiver, and the Garrard 440M record changer.

The Rotel RX-102 Mark II offers quality performance, dependable trouble-free operation, and all the control flexibility the newcomer to stereo will ever need. The Garrard 440M is the latest version of the most tried-and-proven record changer ever introduced.

As a system, you'll be amazed at how much better this system sounds than anything you've probably encountered in its price range.

Make Our Acquaintance This Week.

Quality components **do** sound better, as we hope to have the opportunity of proving to you this week.

Tweeter etc.

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492-4411

Boston University
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738-4411

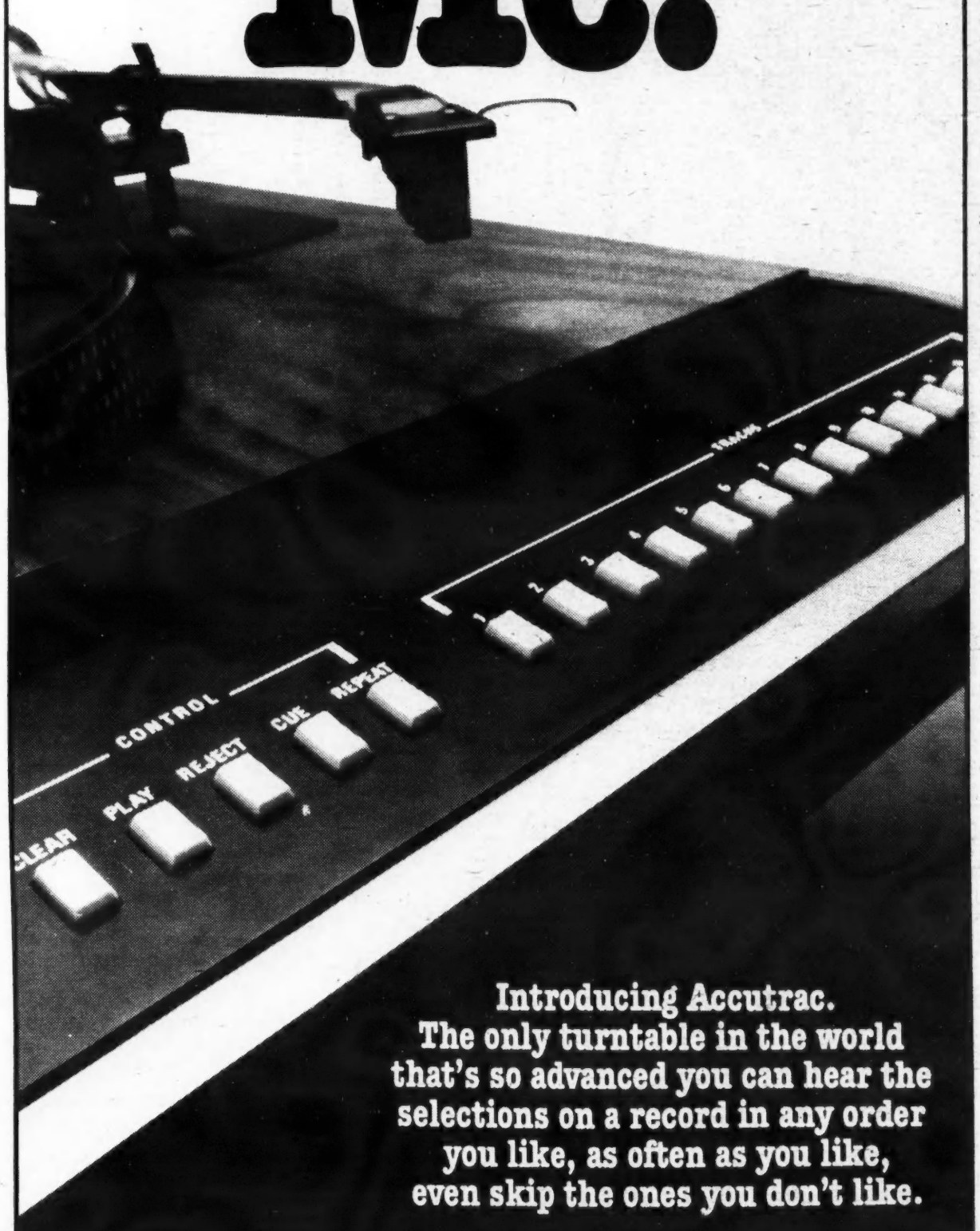
Chestnut Hill Mall
Rt. 9 Newton
964-4411

Opening Soon

Framingham
86 Worcester Road
879-1500

Brockton
849 Belmont Street
583-5146

Play Me.



Introducing Accutrac.
The only turntable in the world that's so advanced you can hear the selections on a record in any order you like, as often as you like, even skip the ones you don't like.

Its father was a turntable. Its mother was a computer.

A marriage of solid-state integrated circuitry, infra-red electro-optics and the latest in direct-drive engineering that produced the most accurate, reliable, noiseless turntable ever invented.

And the most sensational.

We call it the Accutrac 4000. And it's the first turntable in the world that lets you re-arrange the playing order of a record, just by pushing a button.

Suppose you want to hear selections 5, 3 and 7. Simply press the buttons marked 5, 3 and 7.

Accutrac's miraculous infra-red scanning beam, located in the head of the tonearm, reads the surface of the record and directs the tonearm to follow your instructions.

And it can do this, by cordless remote control, even from across the room.

What's more, since the tonearm is electronically directed to the record, you never have to touch it. Therefore, you never risk dropping the tonearm accidentally and scratching a record, or damaging a stylus.

It cues electronically, too.

For example, if your listening is interrupted for any reason, the tonearm will return the stylus to the same groove it left, within a fraction of a revolution. Even the best damped cue lever can't provide such accuracy. Or safety.

And since the servomotor that drives the tonearm is decoupled the instant the stylus goes into play, both horizontal and vertical friction is virtually eliminated. To provide the most accurate tracking possible..

As if that weren't enough, wow and flutter are down to a completely inaudible 0.03% W.R.M.S. Rumble, −70 dB (DIN B). Tracking force, a mere 3/4 gram. And tonearm resonance, the ideal 8-10 Hz.

That's what Accutrac, and only Accutrac, can do. To see Accutrac do it for you, visit any of the stores listed on this page. Today.

There's only a limited number of Accutracs in the area.

And nothing else like it in the world.

Accutrac™ 4000.

ADC

ADC PROFESSIONAL PRODUCTS GROUP a division of BSR (USA) Ltd

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Burlington
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Cambridge
Lechmere

Danvers
Lechmere

Dedham
Lechmere

Harvard Square
Tech Hi-Fi
Eardrum

CIZEK

Continued from page 6

with something we felt was reasonably good."

Various impediments stood in the way of the success of Roy's first speaker business — not the least of which was losing his entire shop to a blaze that struck just two days after his insurance lapsed. Somewhat discouraged, he spent the next half-dozen years filling odd jobs in New York, working at cabinet building, woodworking, polishing and veneering until 1974, when he turned 30.

With the same boldness that had him turn his "failed" creations into a marshmallow roast, he decided to change his life by applying to MIT in electrical engineering. Without knowing whether he would be accepted, he came to Boston with two dollars in his pocket and stayed at the YMCA "rent-free until the end of the month."

In November of '75 he was accepted to MIT and the school gave him an apartment along with a tuition loan.

Within a month, Roy had discovered the hobby shop at MIT and set about combining his woodworking and engineering skills, once again in pursuit of the perfect speaker.

"There's just always been this 'thing' about speakers," he says. "This need to predict everything, to know a speaker intimately."

The final push that put him in business once again was a new speaker produced by another company that Cizek determined was not giving the response it could. The company called him in to consult on their product. He took a pair home, re-engineered them, and returned them to the company executives. They were dumbfounded at the improvement but, because of the exigencies of assembly-line manufacturing, were unable to adopt Roy's innovations.

The new Cizek loudspeaker

Now that his own company is started, Roy modestly demystifies his approach.

"All we've done is go back to known principles and theories, and then carefully follow them through. In any speaker that utilizes a single woofer and a single tweeter, the key is the cross-over network. Most speakers simply do not produce a flat response over the entire sound spectrum. . . ."

Though he's not likely to go for some magical explanation, Cizek's solution to the problem is, in the end, attributable to his extraordinary ear. He seemed to hear something his tests weren't measuring. A total recalibration of the equipment finally revealed that Roy was right. There were two small jumps at 1400 and 1600 cycles; once he found them, he fixed them.

To find out, in layman's terms, just what Roy's new speakers do, the *Phoenix* had the following conversation with their designer:

Q: *In the scheme of source, amplifier, and speaker, which component, would you say, is most important to the system, and why is it that you have devoted your work to speaker design as opposed to the design of another component?*

A: Well, speakers are something that I happened to get a kick out of as a kid. But, too, the loudspeaker is the worst device. It's the most challenging, I think, since it's the farthest from being an accurate reproducer of the electrical signal coming in. A lot of people don't try to reach perfection with a speaker. A lot of people are what we call 'box fillers' — they put a woofer and a tweeter in a box and sell it to whomever, and let it go at that.

My feeling about speakers is different. The idea is to create an illusion that there's an orchestra in your living room; to reproduce, with great precision, all sounds, whether from a triangle, a piano or a bass string. That's the fundamental driving force behind all audio design.

Q: *In the thinking stages of your designing process, did you have to think differently for tape recorders, for records or for FM stereo in deciding how to engineer the Cizek speaker?*

A I never think of those sources separately. I want the speaker to reproduce as accurately as possible what is put into it, no matter where it comes from. I'm not trying to tailor a speaker to a particular amplifier or to a particular cartridge, I'm trying to make the speaker an accurate reproducer — and I think there are a lot of manufacturers who like to think they are trying to produce an accurate cartridge or an accurate amplifier and so all us accurate people are trying to get together to produce an accurate signal, an accurate product. You have a chain of devices trying to take a signal from a record, which is inaccurate from the cutting back to the microphone recording, and to pump that signal out without adding to the inaccuracies which have cropped up in the manufacture of the record. This doesn't mean that you have to go out and spend $4000 or $5000 for equipment. I don't know of any $5000 equipment that is necessarily that good. I think it's a fair statement to make that most loudspeakers above a $400 to $500 calibre are not that good an actual reproducer.

Q: *For the excess money you're paying . . . ?*

A: No. In general. Maybe speakers in the $200 to $300 class can't handle the power the $1000 speaker can, for one reason or another, but as far as accurate reproduction of music, I think there are lots of speakers even in the $70 range that can do a really good job. The main parameter is always to have the speaker reproduce as accurately as possible the signal that's applied to it.

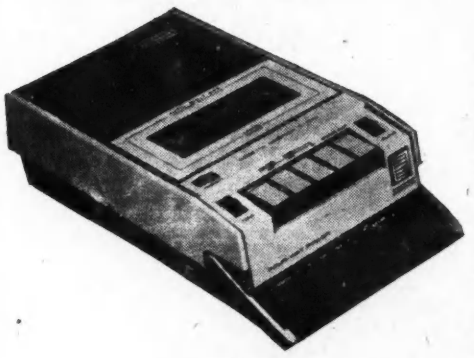
Q: *Why did you feel that speakers currently on the market were not achieving this? What were their pitfalls and how did you think you were going to remedy those?*

A: Given the very hard work done to make tweeters, woofers, and mid-ranges that are basically flat, there was still a fundamental problem in the cross-over network.

[Editor's note: a cross-over network is a circuit (housed inside the loudspeaker) that divides the total input and apportions high-frequency signals to the tweeter and low-frequency signals to the woofer. The cross-over point is the fre-

Continued on page 27

2 SUPER SYSTEMS



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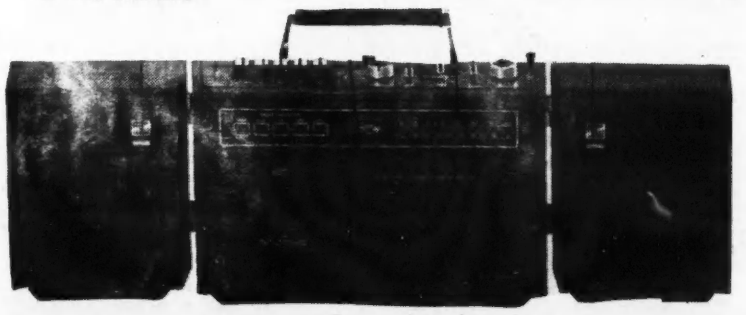

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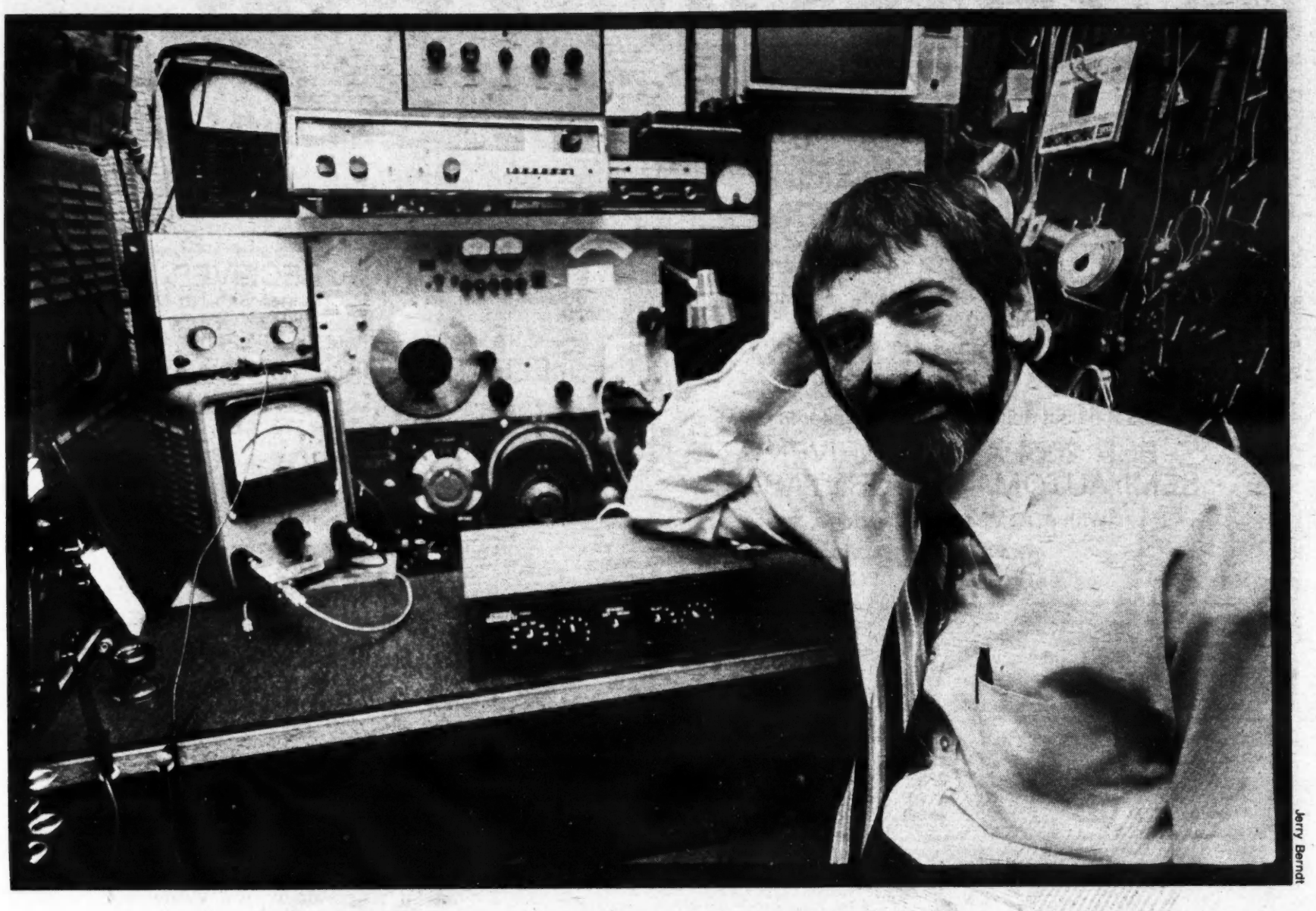

Jerry Berndt

HOW JOEL COHEN SPENDS HIS TIME

A few favorable words on the law of delay

by Phil Bertoni

Until now, there have been only two unmitigated technological advancements in human history: duct tape and the Selectric II typewriter. Unlike fire, the lunar calendar, ballistas, flush toilets, the automobile, and mood rings, all of which are more trouble than they're worth, the aforementioned articles have an astronomical benefit/aggravation ratio. They border on the magical. And now there is a third: time-delay. What's so remarkable about time-delay, you ask? After all, everyone has a time-delay system; you tell the insurance company that you put the check in the mail yesterday, hoping you can scrape the cash together by the end of the week. So what's new about that?

Ah. Wrong time-delay. The time delay that's currently clamoring for admittance to the Hall of Divine Inventions is a technique for eliciting concert-hall ambience from a home sound system. And, unlike the perfidious quad, time delay lives up to its billing. At its best it is overpowering; at its worst, it is satisfying enough to enrage Cotton Mather.

Though it awaited the development of some high-technology hardware (specifically, the charge-coupled integrated circuit) for its realization, the time-delay concept is simple enough and has been with us for a while. If a sound is emitted from a pair of loudspeakers, and repeated after an infinitesimal delay by another set of speakers located elsewhere in the room, the resulting reverberation simulates the acoustical effect of a large hall.

Which brings us to Joel Cohen, and the SD-50 Audio Delay and Reverberation System, of which he is the developer. Joel prefers "developer" to "inventor" because he took concepts and hardware already in existence, brought them together, and designed and built an application for them. Picasso didn't invent painting, either.

That analogy is not so wide of the mark as it might seem, since Joel Cohen is in many ways more artist than technologist. He's just not your average renegade semiconductor engineer, running loose on the plains of entrepreneurism, scraping money off stereo components as they stampede by. To begin with, he is soft-spoken and articulate, both in describing his work and discussing himself (by contrast, most engineers of my acquaintance are hard put to speak in whole connected sentences; you can be kicked out of IEEE for being intelligible).

To label him a technological genius would be unfair. In my experience, technological genii speak overly loudly, in digital representation of speech, and play Go twenty-four hours a day. No, Joel falls more into the category of *wizard*, which, by my definition, is a technologically gifted hombre with a strong esthetic streak. This judgment is reinforced by a certainly wizardly mien of his, an air of relaxed competence, eyes set deep in a somewhat Florentine face (with an occasional gnome-like turn of expression), and a preliminary

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Cohen is not your average renegade semiconductor engineer, running loose on the plains of entrepreneurism . . . . He speaks glowingly of the first time he hooked up his system: "I sat down and listened to one of my favorite recordings, and there were tears in my eyes . . . ."

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COHEN

Continued from page 12

grizzling about the beard.

But he's a lot less solemn and more engaging than any spell-shaker ought to be. He communicates exuberance at several levels; he speaks without reservation of the overriding delight he experiences from fine music finely reproduced, of the pleasure he feels at having provided the means to make that delight general, and of his satisfaction at being able to make his livelihood at what he values most. In describing his entry into the engineering world (which occurred at age eleven, when he built his first amplifier), he says:

"I'm an engineer who became one because I liked high fidelity music, whereas most of my friends did so because they liked ham radio. As far as electronics are concerned, I'm a sensualist. I suppose I'm an artist by temperament, though I never took up painting. My mother was an artist, as was my uncle; my father was an insurance man." He grins. "I'm not sure how that happened — he was a splendid fellow, though. But I myself am delighted to be able to use electronics to provide pleasure to the senses, to be able to build this device, which — it's a pleasure machine, really — is much more satisfying than making something that measures the yield of an atomic explosion."

Hear, hear. But Joel Cohen knows whereof he speaks. Designing a nuclear test monitoring device was his very first job, back in the mid-'50s. Fortunately for audiophiles, and for everyone, he came through that and the ensuing two decades of semiconductor engineering relatively unscathed. He did a long stint as an engineer, then as a director of engineers (during which time he designed the A/D conversion circuits which are at this moment firing pictures to Earth from Mars), then as Assistant to the President of a small electronics conglomerate.

Jerry Berndt

Joel Cohen listening to half his system.

"There were fine people there, and interesting work going on, but after a few years I missed doing something myself," he says. During the time prior to the setting up of Sound Concepts, his company for the manufacture and distribution of the SD-50, the charge-coupled IC was developed, and was being produced for an optical-processing application. Joel wrote to the developers of the device and inquired whether the gizmo might be manufactured without the photosensor component, outlining his notions about an audio-delay device. They didn't answer. Too bad. By now they're victims of future shock. But Joel eventually got his hands on the right ICs and set himself up as a design staff of one, who, aided by his wife, Mary, built test equipment and did the layout for the printed circuits. (Mary's no slouch as a Renaissance person either, being, as she is, a pianist, painter, and electronics technician.)

So after a seeming millenium of evenings and weekends, and only after the first SD-50s were on the shelves, Joel gave up his day job and now runs Sound Concepts full-time. I asked him about the relative merits of the rugged individualist approach to technology, and he replied, "We have it (an audio-delay system) and Pioneer doesn't. The reason being that it requires a commitment to say 'This is what we want to do. This is what it costs to do it right, and there's going to be some demand for it. Let's do it.' But a big electronics outfit's approach has got to be 'We've done a market survey and know that we can sell three million of these things at $279.95 if they do thus and such, so we'll put that into engineering and see what kind of a design they come up with.' "

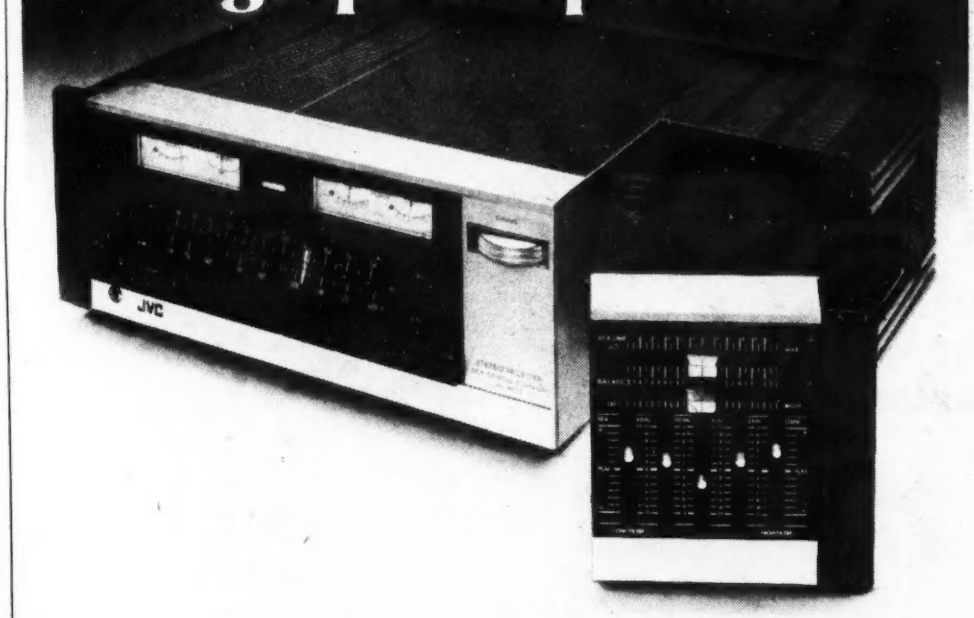
It's undeniably a good thing, to make the product that one wants, the way one wants it, and to make a living at it besides. But what happens when Pioneer or someone like them finally gets its formula together and comes out with a product that does an approximation of the same thing at a significantly lower price? Might not the honeymoon be over? Not according to Joel Cohen. "Our system retails at $600. It's not $599.95 as perhaps it should be, but $600. Hits you right between the eyes. No fooling around. You need a rear power amp and two rear speakers if you're starting out from a standard stereo system. So this is a 'high-end' item — and for the person who can only manage a few hundred in the first place, I just wouldn't try to justify it, though it adds significantly to any system. We've made the product as good as we can make it without including things that would add to cost without significantly adding to features. The basic idea is to pick a price and operate there, and if you do anything with time, you add more features. In a year there will be devices that will sell for half the cost of ours; they won't be as good but they'll be adequate. We won't make those. Instead we'll keep looking at ways to get our product to do more, so that it's clearly worth the investment."

You may have noticed that Joel Cohen doesn't sound much like that rampant mutant species, the Great American Market Blitzer. Yet he is in business, and one might expect that a businessman who possessed a virtual, if temporary, monopoly on a particular product might feel a little temptation. But no Faustian bargains for this wizard. In Joel's opinion there is rather more (or perhaps less) to business than organizing scalping raids. "That's just not the American Way," he smiles, "it's not a pleasant way to go about things. The country is set up for the private businessman, and one realizes the advantages to being in business for oneself and the aids that are available. It's a Horatio Alger kind of thing. Go out and work hard and you'll make it, and it's satisfying. But the other extreme — to run around and get a lot of money from people and gamble it — that would bother me.

"You know, I never worked on aggressive armaments, but at best most engineering is impersonal stuff and at worst it's anti-personal. So — I'm back to where I started at the age of eleven. I'm enjoying it. I've got to say, running a business is not the pleasure of producing the product. It's the aggravation of trying to get the parts and ser-

Continued on page 16

JVC builds in what other receivers leave out. A graphic equalizer.



The only way you can equal the realistic sound capability of JVC's modestly priced S300 stereo receiver, is by adding an expensive, but highly versatile graphic equalizer, to another receiver.

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ARNOLD SCHWARTZ: JUST FOR THE RECORD

A career that's based on standards

by William Manning

Thomas Alva Edison. Samuel F. B. Morse. Arnold Schwartz. Alexander Graha . . .

Arnold Schwartz?

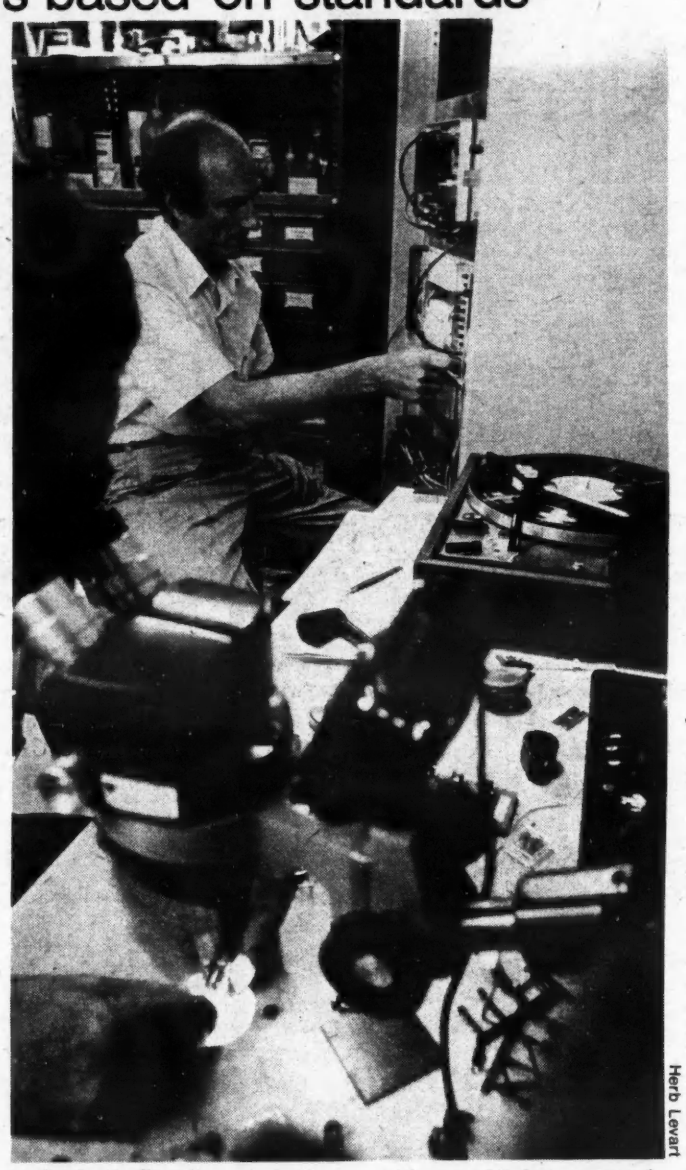
His name may lack the poetry of some others, but Arnold Schwartz has carved a significant place for himself in the field of electronic communications. The designer of the ABC AM and FM radio systems network and former director of disc recording research for CBS, he has turned what started as the basement manufacture of his Micro Point recording stylus — the kind used to make over 300 million records each year — into the Micro Acoustics Corporation, a $2.5 million-a-year research and development operation of which he is founder and president.

Because the state of the art is so advanced, the recording studio can put practically everything that's on the master tape of a performance onto a record. Micro Acoustics' original goal when it was started in 1968 was to produce a stereo cartridge that could transmit exactly what was on the record to the stereo's speakers. Even though it was a small device, it required expensive tooling and no one would extend to Arnold Schwartz and Sanford Drelinger, his partner, a line of credit to cover the cost. To raise their cartridge capital, they designed a speaker called the Micro Acoustic MS-1, a relatively inexpensive system of four high frequency tweeters that is meant to be added onto existing systems to improve the dispersion of high frequencies.

A problem even with the most expensive speakers is that they don't radiate high pitched sounds in the same way they spread about low frequency sound waves. As pitch increases, the beam of sound becomes narrower so that if you sat directly in front, you'd get the right spectral balance, but if you sat off to the side, the high frequencies would drop off as one moved away from the direct beam of the loudspeaker. The MS-1 provides a high frequency resolution that was flat off axis — in other words, spread evenly around the room. The idea is that no matter what the listener's position, he would get the same balance of highs and lows.

The two partners scraped together enough money to get an outside company to make their first production run of 150 speakers, which were received enthusiastically. Several audio magazines that commented favorably on the "spaciousness" of the sound made possible through the improved high frequency dispersion. Financing became an easier matter after that and following the production of their full-sized speakers, the FRM-1 and the less expensive FRM-2, they received the backing they needed to get into the cartridge business. Schwartz contends that their first cartridge, the QDC-1, was capable of making any well recorded LP sound exactly like the master tape. It was the brainchild that grew out of his years at CBS.

When Micro Acoustics' president first came to CBS in 1959, there was no standard against which the fidelity of a record and the performance of the stereo cartridge could be measured. The recording and hi-fi industry at that time were about as isolated from each other as they could be, with neither aware of the limitations in the other's product. Their relationship (or lack of one) could be viewed as a comedy of errors; for years the cartridge people were using calibrated test records to test their cartridges. What they didn't know was that the makers of the test records had based *their* standards on the cartridge manufacturers' response curve. With each thinking that the other's test instrument was correctly calibrated, the result was a classic instance of the blind leading the blind. Between the two, there was no standard at all. To resolve the discrepancies, Arnold Schwartz designed the CBS Test Record Series which became a world-wide standard when it first came out in 1961.



Herb Levart

"Records have been buried ten times already, but they have a tremendous advantage in one respect — it's the cheapest thing to produce. The housing of a cassette cartridge alone has more plastic in it than a record."

"Not only were they calibrated and standardized," Schwartz says, "but they also allowed cartridge people to automatically test cartridges. Up until that time, cartridge measurement was a laborious process of reading a meter and putting down a number, reading a meter and putting down a number. These records were designed to synchronize with various types of automatic recording apparatus. One could automatically and synchronously test the cartridge and have a completely written curve. That was a very important step in standardizing stereo and cartridge performance. In terms of longevity, it was probably the most important thing I did when I was at CBS. At any studio in the world, when you ask how accurate their music is, that's the standard to which they will refer."

People in the record business have known for a long time that a well recorded stereo disc is potentially every bit as good as its master tape. The problem has been in retrieving the sound.

The success of the QDC-1 is derived in part from the use of an electret transducer (the transducer changes the vibration of the needle into an electrical signal) rather than the traditional

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SCHWARTZ

Continued from page 15

magnetic-type cartridge. In the case of the magnetic cartridge, the transducer is composed of a magnet and a coil — and that is its biggest drawback. Whenever a length of cable is put on a magnetic cartridge, it will affect the high frequency sounds produced in the speakers by deemphasizing them. It's an accidental thing, but the external circuit reacts with elements inside the magnetic cartridge and it will attenuate the high frequencies. In the case of the electret cartridge, however, a small microcircuit has been designed to eliminate that entirely, so it is immune to signals from any type of external circuitry and it will, ideally, produce a linear signal — that is, the sound going to the amplifier is a mirror image of the sound that went onto the record from the master tape.

The Micro Acoustics Model 2002-e cartridge is the new, more expensive version of the QDC-1, with the same perfectly linear signal and the same 45 degrees to 45 degrees signal resolution, the latter ability meaning that the cartridge needle can separate the channels that can be found on each of the two walls of the v-shaped groove in the record being played. (Each wall forms a 45-degree angle with a horizontal line. If the channels aren't separated at the stylus tip, there's no place else where it can be done and the clarity of the recording will suffer as a result.)

The 2002-e has the twin distinction of being both the lightest cartridge made and the only one to use the metal beryllium, a strong, light-weight metal of which the cantilever (the bar that holds the diamond) is made. The beryllium in combination with the micro-circuit within the cartridge is desirable for phonograph reproduction because the lighter the pressure of the cartridge against the record (its tracking force), the less wear the record will receive and the less distorted the sound reproduction is. With a tracking force of only one gram, it weighs in at slightly less than the tracking force of the QDC-1.

Few realize that a record can have accelerations of 2000 Gs, beyond almost anything that exists on earth. If one looks at a groove, it is just a path that follows the spiral of a record. When you put music on it, the groove begins to wiggle from side to side, away and toward the center of the disc. When it does this traveling from one side of the groove to the other, it creates accelerations in that 2000 G range. It's an enormous change in velocity and for the stylus to follow, or track, that movement, the stylus must have a very light mass or else it will rattle around in the groove. The advantage, then, of a lightweight cartridge is obvious. If a groove can be tracked with a force of only one gram, you and the record are better off than if you used a cartridge that tracked with a force of five grams.

The founders of Micro Acoustics, rather than producing a conventional magnetic cartridge, opted instead for the electret cartridge design because of the electret's lighter weight, its direct coupling with the transducer (in the magnetic-type device, the stylus has to vibrate a magnet which then induces, in an indirect way, a current in the surrounding coil that becomes the output current) and its superior ability to reproduce the sudden start-and-stop bursts of sound that are known as transients. Music *is* transients. But the possibility that the stereo cartridge and records may be made obsolete by advances in cassette technology doesn't seem to worry Schwartz, who fondly recalls Mark Twain's remark about reports of his own death, and cautions against premature announcements of the LP's imminent demise.

"Records have been buried about ten times already," he told a caller recently, "but they have a tremendous advantage in one respect — it's the cheapest thing to produce. The housing of a cassette alone has more plastic in it than in a record . . . .

"Personally, I don't believe the articles that say the best cassettes heard in tests equaled the sound found on a record. When I worked for CBS, I spent some of my time in their Pittman Pressing Plant in New Jersey where they manufactured tapes, cassettes, and their records. The record was *always* the standard for the tapes."

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Tech Hi Fi Providence, Warwick

COHEN

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vice from one end and trying to get paid at the other end. But the key thing is having a product that gives pleasure."

In the last analysis, that's what seems to be the *primum mobile* of Joel's enterprise — he's just plain in love with his product. He speaks glowingly of the first time that, Edison-like, he hooked up his audio-delay system. "I sat down and listened to one of my favorite recordings, and there were tears in my eyes from the feeling, it was so moving."

I was offered a demonstration. I accepted. We passed from Joel's sparsely furnished sanctum into the second-floor room which serves as a listening chamber, and I steeled myself with a little journalistic objectivity as I sat down to hear. Forget it. My objectivity ran molten down the rug as the first notes of a Brahms symphony came rolling into the room. My hackles rose, my skin turned gooseflesh, and I very nearly cried myself. Prose is unsuited to describe the sensation that arises when music which is majestic in the first instance is compounded with absolute eerieness. The emotional effect is, if anything, more pronounced than in the concert hall, where there is a clearly visible orchestra, rather than an unseen but unarguably real presence.

I turned to the presiding master of illusion and gargled something incoherent, thinking the while that he had really earned his robes on this one. It was magic, pure and simple.

Some of you have no taste for magic. Some of you will want an explanation. When you were children, you watched Mary Martin soaring around the Darlings' nursery and clapped and shouted, "Oh looky, mommy, I see the wires! I see the wires!" Very well, here are the wires.

The principle of audio delay (which term the developer prefers to the somewhat redundant 'time-delay') depends ultimately on a biophysical phenomenon known as the Haas Effect. Some of you may not like the idea of a human in the loop, but tough. The Haas Effect involves auditory memory in somewhat the same fashion as the lingering of retinal images (which makes movies possible, though not necessarily good) involves visual memory. If the human ear perceives a sound, and is presented with the same sound less than 50 milliseconds later, then the second sound is not perceived as a separate event, but blends perceptually with the original. This is palpably a holdover from the days when humans had something to survive for. Human hearing is highly direction-sensitive, and the Haas Effect permits a hearer to identify the source of a sound, even in an extremely reverberant environment. Though echoes may follow immediately upon that sound, the ear does not perceive those that arrive in the first 50 msec., which is presumably enough time for the sound to be located. For this reason, the average Cro-Magnon interior decorator could, while engaged in beautifying the limestone at Altamira, locate the source of an echoing growl as being precisely nine feet behind him and slightly to the left, before he even turned around to see the slavering 1800-pound cave-bear. Much good did it do him.

To leave this scene of primeval carnage and get back to your living-room, however, if an audio signal coming out of the front two speakers of your stereo system is delayed for up to 50 milliseconds before it is emitted from the rear pair of speakers, you will still perceive the sound as emanating from the front, but it will be an unaccountably richer, more ambient, sound. The rear speakers are actually providing an echo, and though that echo is below the threshold of conscious perception, it gives the subjective impression that the listener is in a much larger space.

In an actual concert hall situation, except for the guy next to you coughing his alveoli out, 85 to 90 percent of the sound you hear is reverberant, i.e., you are not the first to hear it — the walls and your fellow concert-goers have gotten first dibs and it's bounced right off them. But before you go out and demand a refund on your season ticket to Symphony, let me assure you that that's the way it's supposed to be. Reverberation accounts for the "liveness" of live music and is what you paid those bucks for in the first place.

In the home stereo application, varying the audio delay between five and 50 msec. causes an apparent variation in the size of the room in which you are listening. With the SD-50, you can also adjust the relative sound levels of the front and rear speakers, vary the attenuation of high frequencies and cross-couple the reverb in the rear speakers, to further resolve the apparent dimensions and acoustical characteristics of your living-room. But the delay is the critical factor.

Just how is this delay effected? Well, playing the system into 100 feet of coiled-up garden hose might just do it, but the sound coming out of the funnel at the other end would have no more fidelity than Richard Burton. This has traditionally been the problem (for audio delay, that is; Burton's problems bear no closer scrutiny): to induce a delay while preserving the overall quality of the signal. Early attempts featured a coil-spring device which suffered from non-linear frequency response and the tendency to

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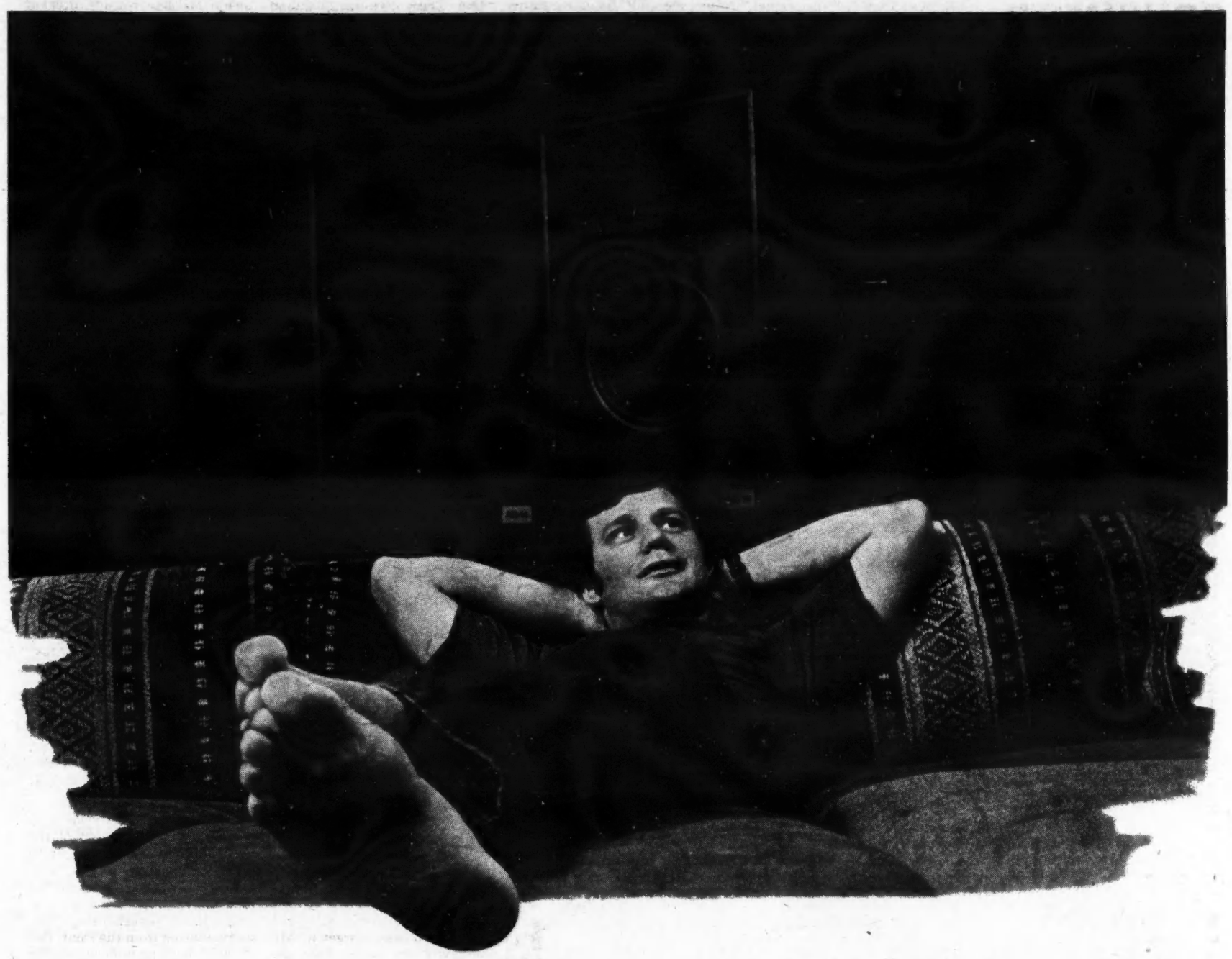

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If you thought you knew all there was to know about the sound of AR speakers, maybe you should pop over to your friendly neighborhood AR dealer and ask him to demonstrate the exciting AR-14. It's part of AR's new generation of acoustic suspension speakers that sets a new standard of accuracy to whet other manufacturers' aspirations.

The AR-14 stands apart from the competition in three particulars you should know about. First, its new 10-inch woofer is mounted in the same size cabinet occupied by our larger, more expensive systems, so you get full accurate bass response right down to the lowest frequencies available in recorded music.

Second, its new 1-inch soft dome tweeter extends high frequency response flat to well beyond the limit of human hearing at extremely low distortion to give you accurate reproduction of those essential overtones you've been missing from speakers with ordinary tweeters.

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We'd like you to know much more about the exciting sound of the AR-14 and have prepared a 36-page catalog on loudspeaker design and selection that will help you make the most informed choice among the many speakers offered in the marketplace. For $1.00 we'll send you a copy by first class mail. Or you may obtain your copy free by visiting your AR dealer as listed below. While you're there, ask your dealer for an A-B demonstration of the exciting AR-14, using music with which you're familiar, against any other speakers in his soundroom. We think you'll find the exciting sound of the AR-14 the one you want to live with.

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Minute Man Radio
30 Boylston Street, Cambridge
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40 Franklin Street, Needham

COHEN

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sound plain old twangy. Something like "The Ventures Go Bartok." What the world (particularly Joel Cohen) has been awaiting is the charge-coupled IC, colloquially known as a "bucket-brigade," which contains 2200 capacitors, 6000 transistors, and a host of other electronic goodies, assembled and printed on a slice of silicon no bigger than a congressman's conscience.

So the signal which emerges from the stereo pre-amplifier proceeds in parallel to the front power amplifier and (via some other hardware, discussed later) to the "bucket-brigade" IC which, in eponymous fashion, divides the signal into samples and passes them on through the series of capacitative elements. The clock which times the sampling rate is variable, and its setting determines the amount of delay (if it sounds implausible to you that shunting an entity through a couple of thousand stages can induce a delay, just think about the last time you visited the Registry of Motor Vehicles). The signal samples, understandably annoyed at the unconscionable delay, emerge sweating and muttering from the IC and go hell for leather for the rear power amp. Meanwhile, the undelayed half of the signal, which had much better connections, breezed through and has long since emerged from the front speakers.

The result is a near-perfect reverberant effect. And it's brought that much closer to perfection by a lot of other hardware that inhabits the SD-50 (you didn't think that little IC was all alone in there, did you?). On its way in and out of the bucket brigade, the signal is passed through a noise-reducing compander circuit (engineerese for compressor/expander), which effectively doubles the signal/noise ratio. And before it gets out the door, the signal passes through a reverb circuit, wherein a portion of the output of each rear channel is directed back into the delay circuit of the opposite channel, with the high frequencies rolled off the signal at each pass. How come? This process simulates precisely the multiple reverberation situation in which sound waves are reflected back and forth across the concert hall, and lose their highest frequencies to absorption by walls, air, and people, at each traverse.

This effect is adjustable through a *reverb* control.

There is also a *rolloff* switch which incrementally reduces the overall high-frequency response in the rear speakers (this can be useful in compensating for an overly "bright" listening room). A *level* control serves to balance the front and rear speaker levels to taste and/or adjusts for differences between front and rear speaker sensitivity and amplifier gain. The *mode* switch permits selection of delayed stereo, mono, or standard four-channel operation; additionally the mono setting causes both front channels to be mixed, and passes them through both delay circuits in succession, doubling the delay. Finally, and most importantly, is the *delay* control, which allows the delay in output to be varied from five to 50 msec. (or from 10 to 100 msec., if the system is in *mono* mode).

All of this, in a unit about the size of a box of Garcia y Vegas, which connects handily into any system with a separately accessible pre-amp, including integrated four-channel setups. Keep in mind that this is not a quad system we're discussing here. It's two separate stereo speaker-amplifier systems, connected via the audio-delay device.

So much for explaining away the magic. I hope you're happy. Except that some of the more hyper among you will point out that this is an analog audio delay device, that it's possible to make a digital audio delay device (though the expense/fidelity tradeoff is rather severe), and that it at least deserves a mention. There. I've mentioned it.

To return again to blissful subjectivity, the effects of the electronic hoedown described above are simply remarkable. As Joel himself puts it, "Mono is like standing outside Symphony Hall, listening to the music coming through the window; stereo is like standing in the doorway, and audio-delay is like going into the hall."

Could be. But the progression isn't as smooth as that analogy might suggest. True appreciation of the effects of stereo by the general public had to wait for the widespread use of cannabis, and Spencer Dryden saying "That's a Nee-nee!" on one side of the room followed by Jack Casady saying "That's a No-no!" on the other. It's sounds coming out of two boxes. I once knew a fellow who had a system worth twice the GNP of Rumania, who left his selector switch on "mono" for six months and never knew the difference, until he went to play "Perez Prado on Chilean Holiday" again. I also have a brother-in-law who is an audiophile (who thankfully makes a decent living and doesn't depend on me to feed his habit. In fact, he gives *me* equipment. You should have such a brother-in-law), and I'm used to listening to records on a succession of progressively classier and bucksier speakers and saying, "Goddam, that sounds real!" Well, with the lashup we're talking about, it *is* real.

Hearing becomes a bodily experience as well as an auditory one; my own exposure had my entire nervous system resonating along with my eardrums. The *presence* is eerie and overwhelming. The auditory and tactile senses swear on a stack of synapses that there's a symphony orchestra in the room, and the eyes deny it.

Therein, I think, lies the explanation for the greater apparent loudness, notch-for-notch on the volume control, of audio delay treated music over ordinary stereo. The auditory cortex asserts "Hey, there's a whole damn band in here!," whereupon the visual cortex vehemently maintains that the auditory cortex is full of mung beans. Their disagreement is noted by the frontal lobe, which knows of only one resolution to the problem of unseen physical manifestations. "Spooks!" it hollers to the hypothalamus, who quivers, "Feet, don't fail me now!" and sweats buckets of serotonin. The smell of fear is of course appreciated by the adrenal glands, who, shuddering at the numinosity of it all, pull the plug on the adrenalin, thereby galvanizing every nerve in the body into the galloping hoo-hahs, and scaring the bejeesus out of the entire autonomic nervous system, which innocently thought it was going to lie back and listen to a little Brahms, maybe blow a few alpha waves.

The overall effect is that of hearing footsteps behind you on the Common at midnight. The senses are taut and straining and your body's gain is turned way, way up; every sound is acutely perceived. Scary, huh? Well, never mind. You could listen to it all day.

And this perceived reality is not only true of recorded symphonic music, in which the ambience of the concert hall lies languishing, awaiting electronic bail; though this is certainly the optimum case, other types of music, recorded in different environments, are greatly enhanced by the intervention of audio delay. I was also treated to some old monaural jazz band recordings, and the sound no longer appeared to be gracefully bouncing off the loges, as with the orchestral offerings, but slamming back and forth between concrete walls and tangling around two-inch lead pipe overhead. It reconstituted everything but mouthpiece spit on the floor and bootleg gin in the wind.

Within wide limits, both the perceived location of the sound source and the apparent size of the room are variable, and you can simulate virtually any sort of musical environment. You can play Gregorian chants and have them float around the clerestory at Chartres. You can spin a Dion and the Belmonts platter and recreate the acoustic space of the back seat of your old Dodge. You can turn down the lights, cue up a crooner, and have Ol' Blue Eyes sitting right there, stroking your thigh. You might not care for this. But, you could probably even put on a side of the Living Strings and simulate the sound of Muzak in an elevator, if you're absolutely trivial-minded. Or you could play your favorite Julie Andrews and simulate Alpine vertigo. You are limited only by the number of recordings in the world.

And perhaps not even by that. Joel tells me that he ran the audio from his TV through the system during the showing of "Earthquake," and experienced California falling apart.

He said it seemed pretty real.

He sums up his love's labors with another best/worst comparison. "At its worst it adds something, and at its best it adds something tremendous. It just doesn't do anything bad and it does a lot of good."

Come and wrap the sounds around you.

The album was recorded live at an outdoor concert, and now it's all coming back to you. The heady magical electricity of a hot, metallic blue night—the air crackling with energy as the musicians tune up—the stage has become an island of colored light, chrome and glitter. Suddenly you're part of the interplay between rhythm, bass, lead and harmony as every note flowers.

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A Very Different Stereo Receiver From Advent.

The new Advent Model 300 is a unique stereo receiver that, within its power capabilities, is designed to sound as good as the best combinations of separate-chassis preamps, tuners, and power amplifiers.

At a suggested price of $259.95, the Model 300 receiver is designed for people who can appreciate but generally not afford the level of sound quality produced by the finest audio components. We think there are a lot of people in that category.

The Holman Circuit.

A major reason why the Advent Model 300 sounds the way it does is an entirely new phono preamp section that is audibly equal or superior to any separate preamp at any price. Designed by Advent's Chief Electrical Engineer, Tom Holman, the new circuit is the product of exhaustive listening, testing, and rethinking.

It came about largely because our checking of preamps of all kinds and prices kept turning up no reliable correlation between test measurements and audible quality. That turned out to be because standard measurements for preamps weren't checking their performance *under actual conditions of use*—a fact that became the center for our own development effort.

We found, for instance, that frequency response measurements weren't being made with signals from phono cartridges, but simply with the use of test generators. This meant that important impedance interactions between preamps and various cartridges of different design—causing very audible differences in actual high-frequency performance—weren't showing up in standard tests. Phono noise measurements also didn't cover the effects of cartridges. And asymmetrical waveforms representative of music weren't being employed to check overall performance under in-use conditions.

If you would like a full technical description of how the Holman Circuit came about as a result of findings like these, we will be happy to send you a reprint of a paper prepared by Tom Holman for the Audio Engineering Society. (Please see our coupon.)

The main facts about the new preamp, however, are these:

- It provides the full performance potential of any cartridge used with it.
- Its effective noise is as low as any preamp's.
- It handles actual asymmetrical musical signals flawlessly.
- It incorporates a unique subsonic filter that eliminates the often severe performance problems (such as acoustic feedback, amplifier instability, added IM distortion in power amps and speakers, and loudspeaker damage) caused by ultra-low-frequency pulses generated by warped and eccentric records and by subsonic turntable rumble. This unique filter is far more effective than a rumble filter, with absolutely no audible effect on wanted low frequencies.

And the preamp sounds, as you will hear, the way we say it does.

The Tuner.

Like the Model 300's preamp, its FM stereo tuner is designed for optimum performance under real conditions of use.

That means it is deliberately not designed for the highest possible sensitivity rating. Our tests of receivers and separate tuners (and subsequent checks of in-use performance) indicated to us that the race for on-paper sensitivity was causing audible problems for many people in the typical urban and suburban reception areas across the country. The straining for impressive sensitivity specs tended to result in severe overload problems in many cases—causing strong stations to show up at several points along the dial and interfere with (or entirely blot out) other stations. The loss of effective reception quality for listeners is very real and important.

The Model 300 is consequently designed for the best *combination* we can manage of sensitivity, selectivity, and overload margin. It shows up virtually one-to-one in this crucial combination in direct comparison with most separate tuners costing far more. The tuner section also offers Phase-Locked-Loop multiplex circuitry that provides excellent stereo separation and unusually effective suppression of the very common "birdie" interference from stations that broadcast background music and other subsidiary SCA signals along with their regular stereo transmissions.

And the Model 300's unique vernier tuning system and LED tuning indicator make for consistently easy, precise tuning year after year, with no chance for dial-cord slippage and apparent changes in station location on the dial. Perfect tuning is indicated when the two LED's light with equal intensity.

The Amplifier.

The Model 300's amplifier will provide ample acoustic output levels with virtually any speaker we know of (including all Advents) under the usual home listening conditions—with no sense of strain or constriction. Yet it's rated very conservatively at a minimum of 15 watts per channel into 8 ohms, 40-20,000 Hz, with less than 0.5% THD. The facts here are well worth going into.

Because of the emphasis on power output in audio advertising, manufacturers in the highly competitive receiver market are under pressure to offer the highest *rated* power per dollar. To do so, the usual design approach operates output transistors at or near their limits and then protects them with voltage/current limiting circuitry.

A receiver designed that way will deliver its rated power into the usual test load (a resistor connected across the output terminals) without difficulty. But a speaker presents a more complex load than a simple resistor, and when a receiver of such design operates into a loudspeaker, the protective circuitry usually triggers at well *under* rated power. The result is that a receiver of that kind just isn't as powerful, in real use with a speaker, as its rating indicates.

The Model 300 approaches things differently. It uses output transistors of the type usually found in units of twice the rated power. It doesn't operate them near their limits, and so doesn't require the usual protection. It will deliver its full rated power into a speaker load, and the actual loudness it can achieve before clipping is more than ample for driving speakers under home conditions.

We realize it may be hard to believe that a receiver rated at 15 watts per channel can do the full job with a pair of speakers. But this one will—and we say this as a speaker manufacturer with a good knowledge of what's needed for satisfying overall sound. It does so well, in fact, that when we introduced the Model 300 to audio salesmen and asked them how powerful they thought it was after hearing it, they averaged a guess of twice its rated power, and some guessed it at four times the reality.

Equally important, the output design of the Model 300 insures that there will be no audible side effects during clipping at maximum output. The protective circuits in many receivers can and often do cause disturbingly audible side effects during clipping, and some of them generate high-frequency pulses that can damage loudspeakers. The Model 300 doesn't.

The Model 300 As A Tuner-Preamp.

If there ever comes a time when a Model 300 user wants higher power output (for super-loud listening in a very big space), the logical direction to go is toward one of the high-power separate amplifiers rated at upwards of 60 watts. (A 30 or 40 watt receiver just doesn't offer that much more actual acoustic output than the Model 300.)

In that case, and in lots of others, the Model 300 can serve as a separate tuner-preamp of superb quality—fully as good as separate-chassis units in audible performance, at a fraction of the cost. It won't offer quite as much flexibility as the separate units, but the sound will be every bit as good.

Not only does the Model 300 offer a tuner-preamp output jack for this use, but it also has an input jack to its power amplifier, so that it too can be used separately—with other speakers, or with one of the new generation of time-delay devices now starting to appear.

The Mobile Model 300.

In addition to the standard Model 300, we are also manufacturing a special version, the Model 300/12, with a switching-mode power supply for use on a 12-volt electrical system in a van or boat or where-have-you away from home. The unique power supply of the Model 300/12 allows it to provide *full rated power in portable use*, so that you can enjoy the same level of sound quality away from home as in your living room.

If you would like more information before going to hear the Model 300, please send us the coupon. Thank you.

Advent Corporation, 195 Albany Street, Cambridge, Massachusetts 02139

Please send:

- ☐ Your literature on the Model 300.
- ☐ A copy of Tom Holman's paper on the 300 for the Audio Engineering Society.

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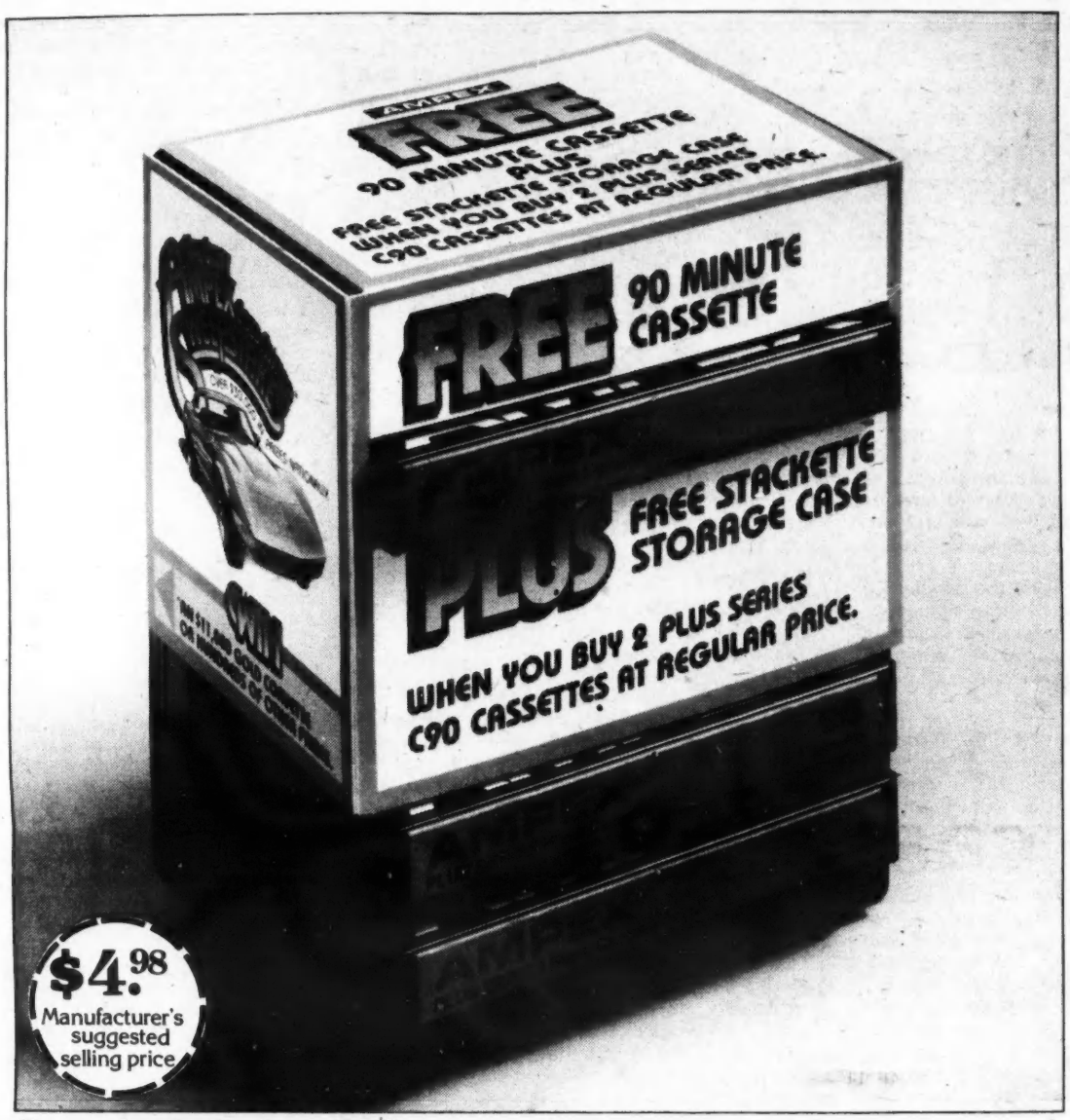

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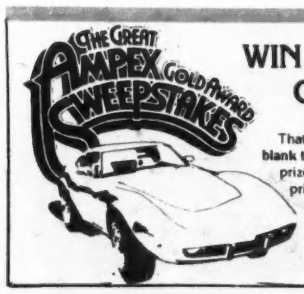

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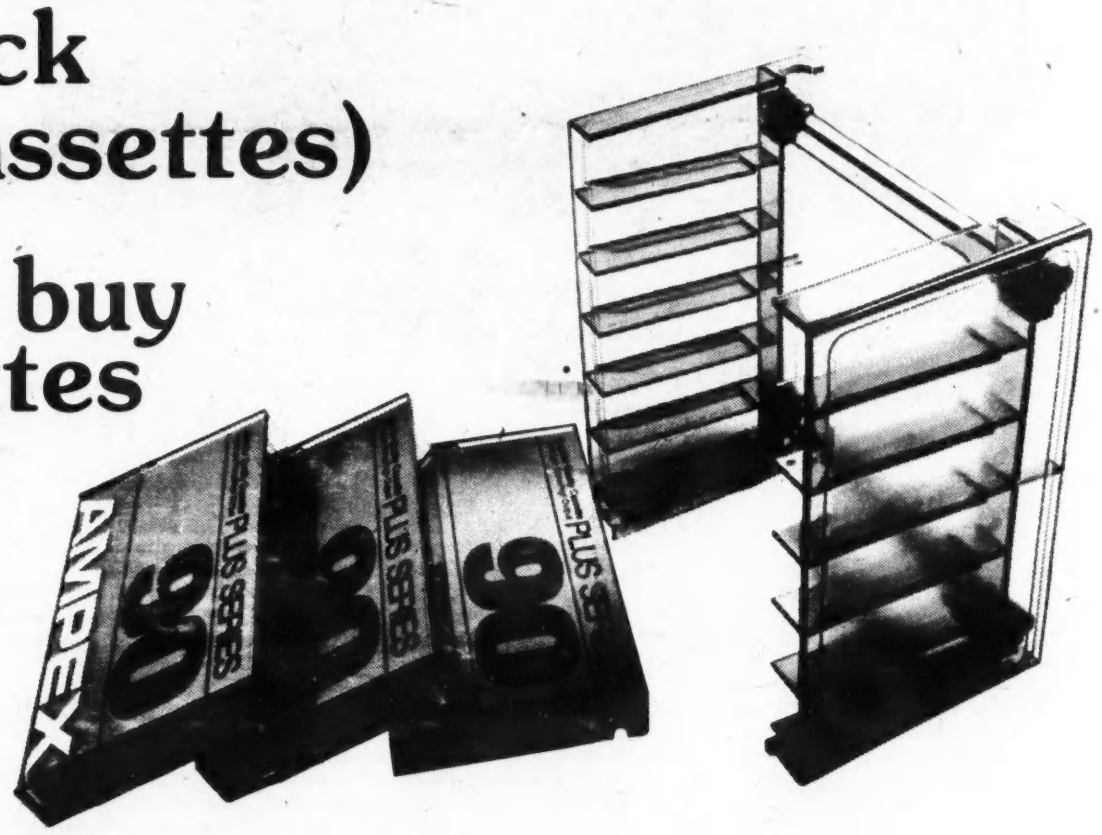

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FROM FUNCTIONAL TO DISNEYWORLD

Raw chrome and colored lights flashing

by Jim Michmerhuizen

"All stereo components are equal . . . but some are more equal than others."

No, to be perfectly honest, I *didn't* make this one up out of whole cloth; it's paraphrased from George Orwell's pig.

This is not necessarily an article about stereo components. But it will certainly look like one.

Ten years ago, just out of graduate school, I began to accumulate a stereo system. I was particularly fond of tape recorders and soon had four. When I made no payments for three months, the owner of the store where I had charged all of this equipment retaliated by hiring me. So for three years I sold components and systems in his store.

The components, the systems, the customers, the other salesmen, the speakers, cartridges and turntables; and again the customers, the factory reps and the Ugly Discounter Across the Street, provided me with a rich experience for philosophical analysis and contemplation.

You think I'm kidding.

Well, think about component *styling* for a minute. Make it a good long minute. Think about (stare at your own system, if you want, so as to keep your feet planted in reality) all of the factors in the design of stereo components that *don't* have anything to do with "Measured Performance."

Think about the three-year cycle of BLACK tape recorders to SHINY BRIGHT tape recorders and back again — a cycle that is apparently written into the genes and chromosomes of the designers at Sony and Teac. Think about the "silky feel" of control knobs that sends Julian Hirsch (and, most of the time, you and I as well) into test-report ecstasies; the "go ahead — kick the tires" look of Crown tape recorders; the way JBL speaker designers manage to suggest Stonehenge and 2001 at the same time in their larger floor models. Remember the explosion of colored lights that appeared in medium-priced receivers about five or six years ago? I believe that it began with Pioneer and was quickly imitated by almost every other Japanese manufacturer. Suddenly we had *blue* dial lights, *green* tuning meters, *purple* input selector indicators, and a whole rainbow of things happened when you pushed a tape-monitor button.

If you're swinging with me by now you should be able to add a whole bunch more items to the list. Take 15 minutes to stare again at your own system, even if it's only a portable phonograph; converse with its soul; learn what it has been *saying* to you for all these years or months of dedicated service.

Before we continue these ruminations, you should know that: 1) This article is *not* one of those paranoid bits of consumer advocacy in which I show how component styling is a big ripoff of consumers by greedy, evil capitalists; 2) This article is *not* (much) about the pushbutton theory of advertising *a la* Vance Packard. I'm not about to massage anyone's ego by picturing him as an innocent victim of psychological schemers with color charts.

You have a right to ask, then, what there *is* that's worth saying about so frivolous a subject as stereo component styles. Well, hang it all, there's a lot worth saying: Appearance and Reality, Karma, Enlightenment. Satori from a speaker cabinet, IT from indigo amplifiers.

You thought I was kidding.

You still do.

To business. I have defined "styling" in very general terms as all those characteristics of a stereo component or system of components that *do not have anything to do with measured performance* of the component or system. Now it is obvious, or should be, that in these general terms it is *impossible* for a component *not* to have some kind of style: the power cord must be some definite length; the dial light has to be some particular color; somebody decides how big the knobs are going to be — and so on.

By analyzing your own system into their categories you can discover a great deal about yourself without going through psychoanalysis, EST, TM or wearing an orange robe and shaving your head . . . .

That's the manufacturing end. But it's equally true from the walking-into-the-store and taking-your-first-look-around end of things. First impressions pop up whether they were cunningly devised or not, and for the most part they're nonverbal. You could try to verbalize them, maybe; but that interferes more than it helps, because you wind up playing word-games, with your senses shut off.

Let's call this very general sort of styling, whether from the manufacturer's or the prospective buyer's end of things, *non-directed style*. Let's separate it from the intentional, conscious styling efforts that win competitions and (possibly) customers by calling the latter *directed* style.

Non-directed style just happens. Somebody in the purchasing department gets a good deal on shiny knobs; next year's models all have shiny knobs. Directed style, on the other hand, happens only when somebody wants it to. It may be because the boss's son just came out of a course in industrial design. It may be because a competing company is winning sales and the boss thinks it's because of their rainbow panels. It may be because the word is passed down

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BETTER SOUND
FOR LESS MONEY

Before you buy a stereo system, come to Radio Shack and listen to Realistic. If shag carpet and high prices impress you . . . sorry. We don't specialize in surroundings. Come to us if you want top quality equipment at the lowest possible price. For example, we've packaged our Realistic STA-64 AM-FM stereo receiver with two Nova-6 floor/shelf systems, Nova-30 headphones, Lab-50 precision belt-drive turntable, Realistic-by-Shure elliptical cartridge and our finest stereo cassette deck . . . the SCT-11 with Dolby* for FM decoding and cassette recording. We've cut $155.78 off the total regular price. A similar system would cost much more elsewhere. We may not have as much "atmosphere," but you'll leave knowing you got the best hi-fi component system for your money.

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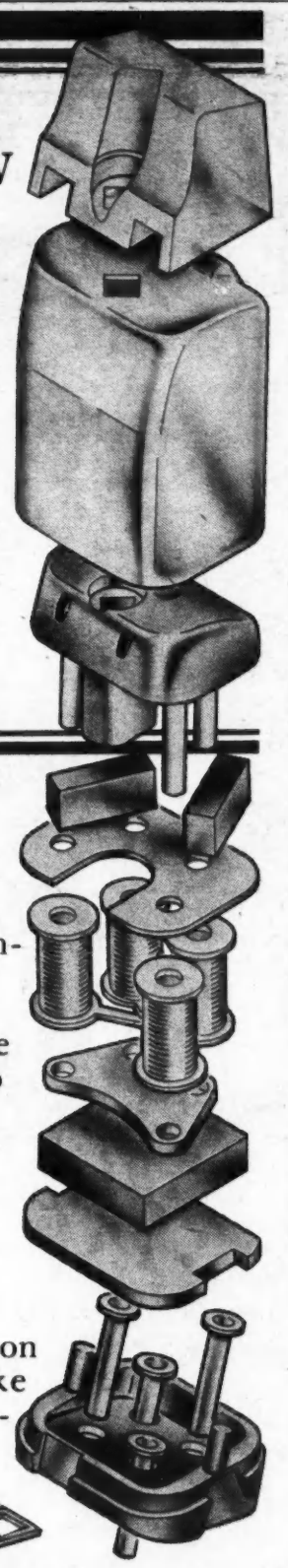
The Best Way To Show You What You'll Get Out Of An Empire Phono Cartridge Is To Show You What Goes Into One.



At Empire we make a complete line of phono cartridges. Each one has slightly different performance characteristics which allow you to choose the cartridge most compatible to your turntable.

There are, however, certain advantages, provided by Empire's unique design, that apply to all our cartridges.

One is less wear on your records. Unlike other magnetic cartridges, Empire's moving iron design allows the diamond stylus to float free of its magnets and coils, imposing much less weight on your record's surface and insuring longer record life.

Another advantage is the better channel separation you get with Empire cartridges. We use a small, hollow iron armature which allows for a tighter fit in its positioning among the poles. So, even the most minute movement is accurately reproduced to give you the space and depth of the original recording.

Finally, Empire uses 4 coils, 4 poles, and 3 magnets (more than any other cartridge) for better balance and hum rejection.

The end result is great listening. Audition one for yourself or write for our free brochure, "How To Get The Most Out Of Your Records". After you compare our performance specifications we think you'll agree that, for the money, you can't do better than Empire.

Empire Scientific Corp.
Garden City, New York 11530

EMPIRE

Already your system sounds better.

STYLE

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to R&D to "go for broke" and make something really beautiful. But, in any case, somebody actually thought about the product and decided how it should look and how it should operate. That's *directed* style.

Now, actually you see very few really nondirected-style components for sale — most of them belong to an earlier age in the history of sound reproduction. A pure example would be a laboratory prototype or one-of-a-kind amplifier out of the pages of a hobbyists' magazine or out of your neighbor's basement. Every manufacturer, whatever abortions he might finally send to his dealers, at least thinks of what the product is going to look like to his perhaps imaginary market. Undirected prototypes, built with absolutely no regard for appearance, are a kind of ideal standard by which we can roughly measure the amount of attention a manufacturer actually gave to his product.

The fun — and a transparent reading of what your docile components have been saying to you ever since you first seduced them from the dealer's shelf — begins only when you assume that *everything* about style is intentional. In other words, assume that *all* the factors not affecting measured-performance are what they are because someone directed that they be that way. Someone, perhaps, who lay awake at night thinking of you. *"He would want the side panels of dark wood . . . maybe projecting half an inch forward from the face panel . . . or should he have it the other way? . . . the power cord must express solidity . . . make it black and heavy . . . a three-prong plug? . . . that'll give him something to think about. . . . wait!* Eureka! *Something about the side panels again . . . ah! of course . . . they will have two large bolts to hold them in place! What power! What a majestic inspiration!"*

You can see, by this time, that component styling has to be taken very seriously indeed. Experts take it so seriously that they have invented a classification of various component styles. By analyzing your own system into their categories you can discover a great deal about yourself without going through psychoanalysis, EST, TM, or wearing an orange robe and shaving your head.

There are three broad categories of design: 1) Functional, 2) "Professional," 3) Disneyworld. Each of these has several subcategories and subclassifications, which we will attend to in order.

Functional

This general style is most often seen in discrete preamp-poweramp-tuner systems, in all loudspeaker systems manufactured within 50 miles of Harvard Square and in certain imported turntables. It is an extraordinarily fluid style; what looks "functional" depends on what functions are involved. In its purest form it is a kind of Bauhaus architecture writ very small and monotonous. Good examples would be the AR turntable, the old AR amplifier, Dynaco products generally.

Curiously, a manufacturer who commits himself to a strict functionalism in his visual design usually winds up making some parallel commitments as to what "functions" he will allow his products to perform. I know of no manufacturer, for example, of sleek, lean, anodized-face-plate-products-without-too-many-bright-lights who would provide a "remote control" option on a receiver. The people who buy pure functionalism, as a design, are expected presumably to be as lean and athletic as their equipment. They jog every morning, and if they are rich they don't show it. They never have more than six people to dinner and never throw large parties.

Uglyfunctional. This is the style for people who find something vaguely sinful in the idea that a tape recorder can work well *and* be pleasant to look at. Predictably, the best examples of this style come from the Midwest. The manufacturer that is most rigorous and thoroughgoing in applying this principle is, without a doubt, Crown. The company has applied this principle consistently for many years, in all of its products: Crown tape recorders are ugly as sin, their power amplifiers are too, their preamp is a visual horror.

It should be pointed out that Uglyfunctional styling is compatible with a high degree of performing excellence. Indeed, that's the whole point. Owners of uglyfunctional systems are fond of collecting junk art, kitsch, and practical jokes. If they are wealthy, they live in slums; if they are middle-class, they live in very plain houses but have very comfortable furniture. They come from Kansas. They like any kind of music that their neighbors don't.

Teamsters. Uglyfunctional must not be confused with this closely related style. In practice, these two are not always easy to distinguish, but their guiding principles are quite different. *Teamsters* designs are based on the principle that the only proper building materials for anything are (in order of preference) 1) reinforced concrete, 2) structural steel, 3) brick and mortar, 4) lumber from old Vermont barns. Note that this principle has nothing to say about what a component should *look like*. It says only what it should be *made of*. The purest examples I have found in the last ten years have been Roberts tape recorders (i.e. Akai up to about 1972) and all of the turntables ever manufactured by Empire, including their current models.

If you guess from this list of preferred building materials that manufacturers who are given over to a Teamster design philosophy do not do much to advance the state of the art, you will be right. Their attempts at researching the properties of pine-knot transistors and brick transformers never see publication in any respectable journals.

They tend, in fact, to be fanatically conservative; that is why, visually, their designs are sometimes so hard to distinguish from Uglyfunctionalism. The old Magnecord 1020, for example, was an eerily effective synthesis of Teamster and Uglyfunctional. Its proportions were exactly those of a large brick; this basic theme was echoed in the color scheme and weight (weight is a very important specification in Teamster designs), and the face panel was pure Uglyfunctional — knobs reduced to sickly pustules, headcovers like a lichenous growth, as though the brick had been marinated for a year at a sewage-treatment plant. Magnecord, of course, is a Midwestern company — Minnesota. The last of the Magnecord 1020's appeared as Heathkits up to about three or four years ago. Heathkit is in Michigan.

Casino Royale etc. Uglyfunctional and Teamsters together form one broad subclass of functional design. Another broad grouping is formed by the Casino Royale, Kubrick (visionary), and Art Deco styles. Casino Royale is a West Coast style best exemplified, as everyone knows, by the product of James B. Lansing Co. (JBL) This is a flamboyant exhibitionist functionalism that occasionally merges with one of the other major categories, Disneyworld (e.g. the Paragon speaker system: two channels of stereo in one nine-foot-long frieze of walnut and burnished metal).

Casino Royale, in spite of its name, is not an inherently ostentatious style. Its basic principle is that things should *look like* their function. A loudspeaker enclosure, for example, on a *strictly* functional design is going to look like a box, "because," says the designer, "that is what the enclosure *is*." But the JBL designer says "No, it is not *just* a box. It is a box the function of which is to make loud sounds." So he designs a loud box, or a box with circles on the grille cloth to remind us that there are loudspeakers inside, or a big colorful box with a tilted top like a gigantic sound bin in which you store your sounds when you're not playing with them. Casino Royale is a playful style. Consider, for another example, the elaborate polyhedra that first put Design Acoustics into our hearts and homes. These "omnidirectional" enclosures were a typical Casino Royale response to the sober academic look and research-paper advertising pitch of the original Bose 901 speakers.

There is, again, a close resemblance between Casino Royale designs and the Kubrick(visionary) style; but, as we noted with respect to Uglyfunctional and Teamsters, the underlying principles are quite different from each other. A few examples should illustrate the difference.

Superficially, the Ohm A and Ohm F loudspeakers look like pure C.R. Their pyramidal shape, truncated, suggests a kind of elemental force. A friend of mine has four of them in a 13 x 15' living room, and it looks like Easter Island. You expect to hear him start working spells and incantations behind your back, and you start to wonder about how the Incas carried out human sacrifice.

So far, so much like C.R. But when you take the grille tops off, you find a pyramidal loudspeaker. Aha! The enclosures *had* to look like that. They couldn't have had any other shape at all! This is where C.R. and Kubrick (visionary) part company. No C.R. designer would *bother* to invent a funny-shaped loudspeaker just to justify a funny-shaped enclosure.

The distinguishing characteristic, in other words, of what I am calling Kubrick(visionary) is that (like Stanley) it takes itself very seriously. This is entirely at the opposite pole from the playfulness and even whimsy of C. R. designs. When Nakamichi gives us a series of wedge-shaped components, it is with the veiled suggestion that we *ought not want* boxes anymore; that the achievement of the wedge is an exercise in enlightenment, a surmounting of old and arbitrary limits to our imagination. The same holds for the straight-line B&O turntable. It is basically a moral statement. Owners of such products speak very little, and when they do say something it is never quite what you would have expected to hear.

Well, that is K(v) at its best. It does have occasional grotesque lapses, as in the Transcriptor turntable and arm that was being imported from England a couple of years ago. Instead of supporting the record on a platter, it had three spidery and very shiny arms — a kind of tripod — and it looked like one of the Martians from *War of the Worlds*. A friend of mine who had one swore that at night it opened one eye and tried to escape from its shelf. At its worst, K(v) becomes merely futuristic and, like C.R., verges on Disneyworld.

Art Deco is represented in this country mainly by the product of Braun, a German company. For a while they were making a little of everything — speakers, amplifiers, turntables, and a tape deck. All of these things were gun-metal gray, and they all had

Continued on page 26

We erred on the side of modesty when we published the specifications and performance data of our Quartz Locked AM/FM Stereo Receiver.

Then Hirsch-Houck, a famous independent audio testing lab*, put our TX-4500 through the mill on their own. You know who they are . . . possibly the best known in the business. They said and we quote:

". . . virtually impossible to incorrectly tune in an FM station."

". . . sound quality in FM reception with the TX-4500 will be determined only by the quality of the broadcast program."

". . . when playing records the sound had a definition and clarity that were unmistakable."

In fact, they compared the TX-4500 favorably with component tuners and amplifiers, and we didn't lose. While we claimed the TX-4500 would deliver 55 watts per channel, minimum RMS at 8 ohms, both channels driven, from 20 Hz to 20 kHz with no more than 0.1% Total Harmonic Distortion, they found Total Harmonic Distortion less than 0.02% at middle frequencies; 0.09% at 20 Hz, and 0.04% at 20 kHz.

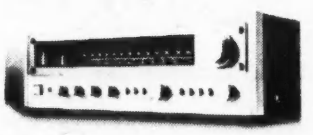
We said IM distortion was 0.1% at 1 watt. They found it between 0.01% and 0.02% at most power levels from 1 to 40 watts.

You should also know about our FET/4-gang variable capacitor front end. Our circuitry with 70 transistors, 8 IC's and 59 diodes, plus the FET. About provision for three sets of speakers and three tape recorder circuits, each controlled by its own pushbutton.

You might also be interested in detented tone controls and center detent balance control. Phase Locked Loop Multiplex.

But mostly, you have to see what Quartz Locked tuning does, verified by the lab that the system invariably resulted in the lowest possible distortion and noise and best stereo separation the receiver is capable of.

There's no way we can tell you everything about our "Studio on a Shelf". There's too much, and we're too modest. But, you can find out at your Onkyo dealer. He may even have a copy of the lab report. If not, write us for a copy.



While you're at it, look into the TX-2500 also. It costs a little less than the TX-4500 and performs almost as well. Instead of Quartz Locked tuning, the TX-2500 features Servo Locked tuning. In our own modest way we have to say it's pretty good.

So, if you can't go for the top of our line, you can come pretty close. And the best place to start is with an Onkyo dealer.

*Popular Electronics, August, 1976.

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STYLE

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rounded edges and funny-looking pushbuttons. The overall impression was of a faintly sinister uniformity and suggested strongly the atmosphere of *Cabaret*, or of *The Great Gatsby*. Something of the same look can be found in the new Advent receiver — owing no doubt to their obstinate insistence on using round vernier knobs for tuning, instead of the all-American string-and-pointer straight-line tuning.

A formerly popular style, Provincial Inscrutable, has few adherents today and is found only in Uher tape recorders and older Tandbergs. Its distinguishing marks are incomprehensible instructions, and connecting sockets that will not mate with any of your patch cords. It was a prestigious but impractical style that reached its peak in the early '60s. Present owners of Provincial Inscrutable pieces are likely to be over 40 and will fight rather than switch. They are usually self-taught in several European languages and have a basement hobbyist's knowledge of electronics. Their clan structure is strong, and ownership always passes to the eldest son.

"Professional"

This is a style intermediate between Functional and Disneyworld. The defining example here would have to be the Dokorder four-channel tape recorders. The lines are clean enough to suggest, superficially, membership in one of the functional schools we have discussed, perhaps a low-grade Kubrick(visionary); on the other hand, the idea of designing a container for an inexpensive home tape recorder so that it visually suggests a studio machine is sheerest Disneyworld whimsy.

The quotation marks around the word are an essential part of the definition. Professional tape recorders themselves are invariably rigidly functional in design, and the functions they must fulfill are stringently defined. But "professional" (with the quotes) is an entirely different story. It is a style to stay away from, mostly. Owners of "professional" and "professional-type" equipment are invariably inexperienced amateurs. They are emotional and easily excited; they love their equipment passionately and will tolerate no criticism of it. They like the same music that their neighbors do, but they like it a lot more. They are not rich, and they tend to die young and intestate.

As a style, "Professional" is confined pretty much to tape recorders, mixers, and microphones. Further discussion of these would take us too far afield from the world of home stereo, so we will turn to the last major category.

Disneyworld

The most imaginative and fanciful creations of the component industry come from designers trained in Disneyworld styles. Here is where we find such charming bits of fancy as covering a five-inch loudspeaker with six yards of grille cloth "as though to suggest large reserves of speaker power." Here all is illusion and wizardry, perfectly sculptured plastic "horn tweeters" without drivers; here all is ornament and eloquent poetry.

Few people are aware that the beginnings of Disneyworld style can be quite precisely dated. The style began shortly after the Second World War, when RCA designers put two little red dots on the front of a tonearm and called it the "Cobra" arm. There are purists who claim that the style has not seen such giddy heights of imagination since. I am not one of them; on the contrary, it seems to me that every year brings the DW designs to higher levels of metaphorical expressiveness. At least three times a year I make a pilgrimage to Lechmere's to see what is new in Compact Systems (a field in which great advances in DW styling are usually first manifested).

I do not mean to imply that components in the DW style are invariably poor performers. To allow *any* relationship at all between the look of a piece and its performance — even an inverse relationship — would be contrary to DW principles. A really masterful DW design may not look like a stereo system at all. It might, for example, fleetingly suggest the NASA center in Houston, or Anne Hathaway's cottage in Stratford-On-Avon, or HAL 9000 (I knew I saw those eyes before somewhere). As the state of the art continues to advance, the field of choice for DW designs grows wider. Soon, for example, it will be possible for your stereo system to look like a dirty shirt or a philodendron plant. You can't hold back progress.

Consider the development of the stereo compacts. The original KLH compact, the Model 11, was a dowdy, frowzy design in the little-known MIT Gothic style (a weak and unprincipled variant of Uglyfunctionalism, seldom seen today except in the surviving Advent 201 cassette recorder). Today, from dozens of different manufacturers, there are hundreds of little sculptured poems in plastic and walnut to choose from, no two alike in performance, longevity, serviceability, or serial number. In the face of such variety, who can deny that DW has progressed mightily, and is indeed about to overcome the world?

Among manufacturers of components properly so called, Pioneer has been most consistent in developing, along DW principles, a distinctive style of its own which experts call Teamster Apocalypse. I have referred to it earlier by its distinguishing characteristic, the multitude of colored lights provided wherever possible.

A brief survey such as this cannot hope to do justice to the enormous range of subtle design variations found in the stereo component industry. Many manufacturers have been omitted here simply from lack of space. The last five years, for example, of Tandberg design are of historical importance as the company has gone from Bergman Decadent through a mild flirtation with modified Kubrick to a full-fledged Scandinavian version of Teamster Apocalypse.

What we have done is, however, significant. We have described and defined the basic categories in terms of which most systems can be analyzed. Armed with these basic concepts, you should practice analyzing the contents of your nearest stereo store until you can identify at a glance the subtle nuances of color and proportion that distinguish closely related styles such as San Simeon and Creaturefeature. As your discrimination improves, you may feel the need for additional descriptive names. Feel free to coin them. One very good way to practice is to bring a friend to the store with you for critical discussions.

True connoisseurship, though not easily achieved, brings great rewards. One is that you will be able to pick out stereo systems for yourself (and even for your friends) without the slightest hesitation over questions of performance, reliability, etc. A simple checklist of personal characteristics such as height, weight, age, birthplace, sexual habits, and so on, will provide you with an infallible "fit" between purchaser and system. The other, more subtle benefit is that you will be able to analyze people by their component systems and thus know how to deal with them to your own best advantage.

You still think I'm kidding.

In the hi-fi stereo market?

...about B·I·C Multiple Play Manual Turntables

Multiple play manual turntables are a new concept pioneered by B·I·C. They are belt-drive turntables which provide six different combinations of manual or automatic operations. They are the first turntables which make it possible for a maze of mechanical linkages to be engineered out of the system, simplifying it and resulting in better performance, greater reliability and longer life.

They are the most advanced instruments of their kind. Now there are four B·I·C models — a high performance turntable for every fine stereo system.

B·I·C 980 (top) — 24 pole 300 RPM motor, solid state electronic drive for ±3% pitch variations, built-in lighted strobe, adjustable rate cueing, unique programming system, gimbal mounted tonearm, 4 pin cartridge connector, 15° adjustable stylus angle. $199.95 (less base and dust cover)

B·I·C 960 (bottom left) — Same as 980, without speed control and strobe. $159.95 (less base and dust cover)

B·I·C 940 (bottom center) — Same basic performance features as 980 and 960, with differences in trim and refinements. $109.95 (less base and dust cover)

B·I·C 920 (bottom right) — Same basic performance features as the higher priced B·I·C models but built on a smaller unit plate with conventional 10½" platter. $79.95 (less base and dust cover)

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Tech Hi Fi (T)
240A Newbury Street
Tech Hi Fi (T)
870 Commonwealth Avenue

BROCKTON
Persson Radio (V)
995 Main Street
Tech Hi Fi (T)
375 North Montello Street

BURLINGTON
Eardrum (T)
160 Cambridge Street
Lafayette Radio (T)(V)
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Eardrum (T)
16 Eliot Street
Minuteman Radio (T)
30 Boylston Street
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52 Brattle Street
Tech Hi Fi (T)
38 Boylston Street
Tech Hi Fi (T)
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Lafayette Radio (T)(V)
Endicott Plaza

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Tech Hi Fi (T)
850 Providence Highway

FRAMINGHAM
Atlantis Sound (T)(V)
248 Worcester Road
Tech Hi Fi (T)
280 Worcester Road

HANOVER
Olde Colony Stereo (T)(V)
Farmers' Market (Route 53)
Olson Electronics (T)
Hanover Mall
Tech Hi Fi (T)
Hanover Plaza (Route 53)

NATICK
Lafayette Radio (T)(V)
1400 Worcester Road
Olde Colony Stereo (T)(V)
Sherwood Plaza

NEEDHAM
You-Do-It Electronics (T)(V)
40 Franklin Street

NEWTON
Stereo Shop (T)
80 Langley Road

PEABODY
Atlantis Sound (T)(V)
10 Sylvan Street
Olson Electronics (T)
North Shore Shopping Center

CIZEK

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quency which is apportioned equally between the woofer and tweeter — the overlap. Frequencies below the cross-over point will go primarily to the woofer and frequencies above will go primarily to the tweeter.

The tweeter can, and does, reproduce frequencies that are below the cross-over point, but the lower the frequency of an incoming signal, the greater portion of that signal will be directed by the cross-over network to the woofer. As the frequency decreases, you eventually reach a point where essentially all information is sent to the woofer and none to the tweeter. The converse explanation applies to signals above the cross-over point.

Perhaps the most critical thing about designing a cross-over network is the selection of the cross-over point.]

For example, in reproducing certain music the tweeter may be reproducing all or most of the signal, and the woofer not very much. Depending on the point where you are crossing over, I feel that it is proper, or at least it is a good thing, if the tweeter and woofer share as much of the signal [frequency range] as possible.

Q: *How is your cross-over network constructed?*

A: In this case it consists of one capacitor and one inductor. By placing the drivers [woofer and tweeter] across these components, a certain amount of the high frequencies will be blocked [filtered] going to the woofer, and a certain amount of the low frequencies will be blocked going to the tweeter. It's more critical as far as the tweeter is concerned, because of its being wound with small wire, being a small voice coil, and being a small unit itself. It can't handle a lot of punishment. It's good if you can make it work as little as possible in terms of physical vibration and movement while still producing a lot of sound.

Q: *So, how does this cross-over network differ from those in other speakers? You mention one capacitor and one inductor — isn't that pretty standard?*

A: Yes, it is. The network itself is not complicated. It's a well-known device, but it has never really been used properly before. It's not the network that's really my secret — if you want to put it that way. What's important is the idea behind *compensating* the devices, the woofer and tweeter, that are going to be plugged into this network. My cross-over network is designed to be terminated by a resistor. A woofer and a tweeter do not constitute a resistor — and so, electrically, we have to compensate these two devices so that they become a resistor, or at least close enough to a resistor that the cross-over network can operate properly. That way we get out of it what we put in, which is the level of efficiency that you're looking for in any electrical system.

[Editor's note: an electrical load — anything powered by electricity — exhibits some combination of three characteristics: 1) *resistance* (which can be thought of as electrical friction), which converts electrical energy into heat; 2) *inductive reactance* (which can be thought of as electrical inertia), which discourages any change in current flow; 3) *capacitive reactance* (which can be thought of as electrical elasticity), which stores electrical energy.

Resistance is the only one of the three characteristics that remains constant at all frequencies. The other two vary depending upon the frequency of the signal applied to them. In the case of loudspeakers, making the drivers (the load) resistive keeps them from interfering with the frequency selection process performed by the cross-over network.]

Q: *Can you describe how you make your drivers resistive?*

A: If you put an inductor and a capacitor together, they compensate for each other. The capacitor stores up energy at a certain amount of time later than the inductor so that they cancel out. So when they spit back, one is giving out while one is giving up.

Q: *And the value of that resistor is the same throughout the whole band?*

A: That is correct. Our first decision was to push the laws of physics as far as possible in terms of getting the strongest possible bass response within what physical law will permit, and without blowing up an amplifier. We decided to design the speaker for four ohms. That was my beginning, and that sets a lot of criteria. Our next decision was to design a two-way instead of a three-way speaker, and that was basically a decision that was made according to price — what we wanted our speaker to cost.

Our next decision was how much power the tweeter would have to handle, if we crossed it over at 1500, 2000 or 3000 Hz. The object, of course, is to try to cross the tweeter over as low as possible without blowing it out, because the woofer really doesn't like to go out to 1500 or even to 1000 Hz. The dispersion of the woofer is not as satisfactory as we would like, let's say, after 600 or 700 Hz.

We first had to run lots of tests to find out where to kick the tweeter in because music has a lot of harmonics in the upper range, where there isn't a lot of *fundamental* energy from instruments. In other words, a concert A — 440 Hz — is driven by the woofer, but you go an octave above that to 880 and there won't be too many fundamental notes. Most of the fundamental notes are going to be around the area from about 250 to 1000 Hz. Then, the harmonics are above that.

By the time we get to the tweeter, at 3000 or 4000 Hz, those harmonics are at a much much lower volume level, but it's still important that they be reproduced. You want to kick the tweeter in as low as possible without letting through a lot of fundamental energy that could possibly blow it out. The real problem is not the cross-over point; the problem is what happens to these two drivers below and above their cross-over. Does the woofer put out a lot more signal above cross-over, which would be dumb? Does the tweeter put out a lot more energy after it's already supposed to be crossed over? In other words, you could design a cross-over so that it works right at a given frequency, say 1500 Hz, but what happens at 1200 Hz?

Q: *What kind of testing procedures did you use in the development of the Cizek speaker?*

A: Well, there are various tests that one does. We have an anechoic chamber in our shop that's good to about 500 Hz, and I'm sure you heard the signal generator when you came in. But the original development of the speaker is usually done in an outdoor environment, in a two-pi environment, which means that the speaker is buried in the ground with the face of the speaker flat with the ground surface. It's measured also in a four-pi environment, which is just hanging in free space with nothing around it, and that gives you an idea what the edges of the cabinet look like acoustically and things like that

Q: *What is the function of the front control knobs on your speaker?*

A: The HFL control, the level control, simply increases or decreases the whole tweeter range. In other words, it raises and lowers the volume of it, similar to a volume control, and that control affects the entire range of the tweeter, not just part of it

The concert hall adjustment,

Continued on page 29

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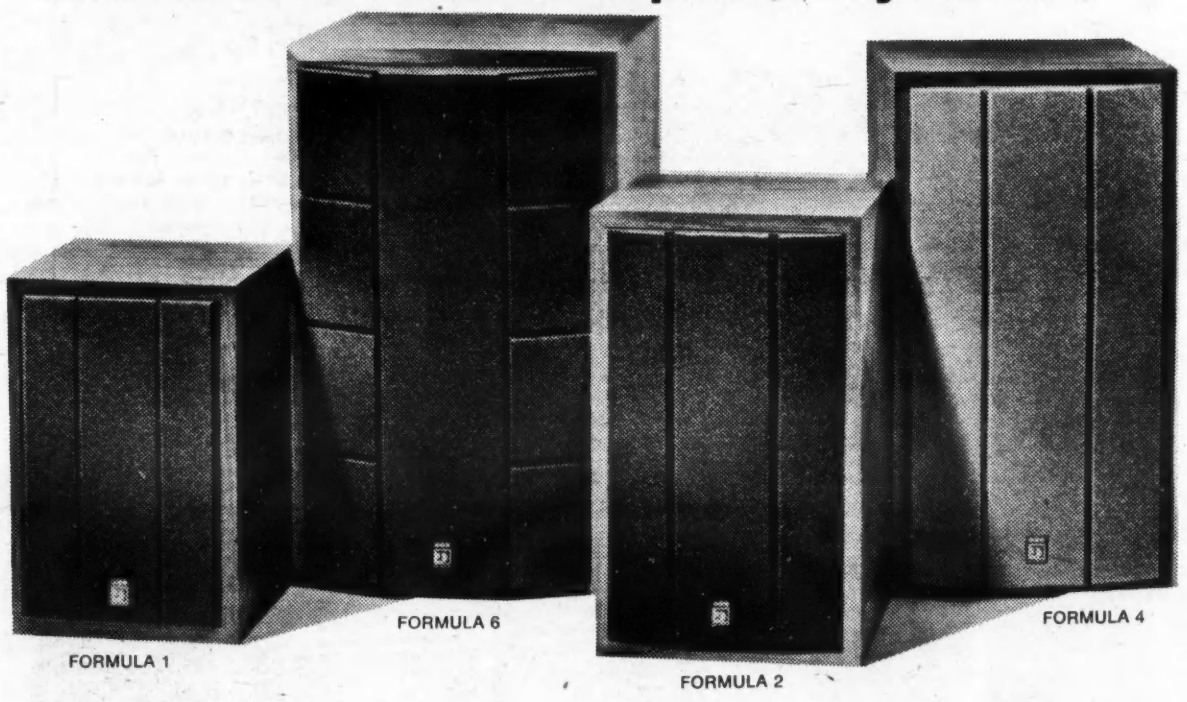

FORMULA 1 FORMULA 6 FORMULA 2 FORMULA 4

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CIZEK

Continued from page 27

or the HFC, is a control which starts the tweeter sloping off or changing level. Let's pick a point. Say in the C1 position, the tweeter is basically flat from its cross-over point to 6000 Hz and then it drops in a gradual slope on to the end of its range at 18,000 Hz or whatever. In the C2 the rolloff starts at 4000 Hz, in C3 it starts at 3000 Hz, in C4 it starts at 2000 Hz, so you have an adjustment for how much the tweeter is going to drop off in its sound pressure level. The reason for this adjustment is that some recordings are boosted in the high frequencies. By using this control you can make them sound a little better. The original reason why we put this in is that when you are sitting in a concert hall, say 15 or 20 rows back, the high frequencies reach you at a lower level of intensity than the low frequencies do, and so if you're trying to create the illusion of the concert hall, you turn this thing down and you get the sloping off of the tweeter itself.

The third adjustment handles the Q. This does a couple of things. It allows the person with a more powerful amplifier to be able to have a more extended bass response with the sacrifice of a little bit of transient response. Some people, including myself, like to hear very deep, earth-shattering organ pedals. In order to get that you have to have a lot of really deep bass. By putting the Q adjustment in the 1.0 position you will be able to extend the bass flat to 38. Hz, which is prtty low. In the .6 position the curve is a little more than four dB down at 38 Hz. Basically, there is a particular time when this is used: when you are listening to organ music and you have a fairly hefty amplifier.

[Editor's note: loudspeakers can be described in terms of the three electrical characteristics listed above. The "Q" is the ratio of a loudspeaker's capacitive and inductive characteristics to its resistive characteristics, *i.e.*, the inertial and elastic characteristics to its frictional characteristics.

The Q of a loudspeaker can be altered by electrical means. If, for example, a small resistor is added in series between the amplifier and the speaker, it effectively lowers the damping factor of the amplifier as seen by the speaker. This results in the amplifier's exerting a less precise control over the motions of the speaker, which in turn allows the elastic and inertial characteristics of the speaker to become more dominant. From the ratio above, this necessarily increases the "Q".]

Q: *Are there other recommendations for your speaker's application?*

A: Well, I recommend to get the smoothest response out of it to mount it into a wall or possibly into a bookcase surrounded with books — a two pi environment — where there is as much surface flush with the front of the speaker as possible. You'll get a smoother response because the highs won't be affected by the sharp edges of the cabinet.

* * *

In time the industry and its consumers will judge the merits of Cizek's variable Q and the circuits he has designed to compensate his drivers, but the idea of shunting the woofer and tweeter to make them act like a resistive load itself has one immediate advantage. Doing this allows the amplifier to operate into the loudspeaker more efficiently, thus — if your amp is worth its salt — improving the quality of sound.

ADVENT

Continued from page 4

is a look at what's happening in the string of brick buildings along Albany Street.

Kloss is doomed to go through life known as "the K of KLH" because he founded that company with two partners in 1957, using money from a previous venture, Acoustic Research, that he co-founded in 1953. The *New Yorker* dubbed him "one of the Cambridge geniuses, a small but recognizable group." His Hush Puppies style and fringe of white hair are assuming mythic status.

"Every time Henry has had an interview with somebody, they write about how he rides a bicycle to work," grumbles Andy Petite, Advent's audio products manager and one of a number of colleagues from KLH days. "Henry hasn't ridden a bicycle to work since 1969."

Myths aside, Advent has been an unusual corporation ever since Kloss, leaving KLH (which had been sold to Singer) started it in 1967. "We definitely wanted to make two kinds of products," Petite explains, "either products that were innovative or products that demonstrated a new price-versus-performance relationship."

An example of the former was Advent's first product, the Frequency Balance Control, which, added to an existing component system, allowed a listener to remove harshness from a record, increase bass, correct for room boom, etc.

The Advent loudspeaker, introduced about the same time, falls into the latter category. The marketing department liked to hook audio dealers on it by demonstrating the speaker and asking them to guess its cost. Petite remembers trying the strategy on three experienced salesmen at Harvey Radio in New York in 1969. One man guessed $300, another $225. The third said it had to be cheaper, knowing Kloss, and guessed $200. The speaker actually retailed for $112 then, $140 now.

Typically, Kloss companies produce breakthrough products like that — the first credible "bookshelf" loudspeakers, KLH's portable "stereo in a suitcase," the first high-fidelity FM table radios.

And there are few of them, usually, because the KLH and Advent management nucleus always shared a horror of what Kloss calls "the Detroit game" of annual model changes and deluxe gimmick-laden products. Kloss figured his customers brought FM table radios to listen to good music, so he left out clocks, alarms, luminous dials and AM.

On the force of such products and of a network of audio dealers who helped promote them (Advent products were never distributed through mass outlets), the company first turned a profit in fiscal 1971, four years after its founding. Its net sales reached almost $4.1 million that year and climbed to $6.2 million in 1972, $9 million in 1973 and $11.8 million in 1974. It eventually spread to seven buildings and employed 750 people. But as the sales figures increased, the profits plunged — from $188,000 in 1972 to a paltry $54,000 in 1974.

"I would call it exciting," recalls Jim Keith, who'd risen from a packer at Acoustic Research to director of manufacturing at Advent. "It isn't like we were real buddy-buddies, but we were caught up in the excitement that a Henry Kloss venture is."

Andy Petite puts it more precisely: "There was definitely a community of purpose and outlook."

In a sense, though, Advent's success in audio was only a preliminary, a way to build up business while Kloss worked to perfect and to begin manufacturing the product he'd labored over since leaving KLH — the VideoBeam projection television system.

VideoBeam's free-standing projector-receiver console throws a clear color picture onto a curved, seven-foot (diagonal) screen. For what seems like years, reporters have been visiting Advent's showroom on Albany Street and publishing raves about the VideoBeam, its immediacy, its intensity, its dissimilarity to conventional TV; but in fact, it was not until the summer of 1973 that the first sets were sold, and not until 1975 that the VideoBeam brought in 20 percent of Advent's total sales. And it was in 1975 that Advent's balance sheet indicated that the audio line could no longer carry the enormous costs of developing the VideoBeam.

"It's not been widely appreciated, the magnitude of that job," Kloss says of the TV. Nobody at Advent — executives or assembly line workers — had worked with television before, and the process of learning how to make and sell them preoccupied hundreds of people for months on end.

"Classically," Kloss continues, "the way of doing it is to go out and buy a company that knows how to do it. Maybe I shouldn't have tried it, to quickly create a new technology and a new product with the people who were there."

He estimates that VideoBeam startup required 2000 people-months and $1.5 to $3 million more than expected. He considers it "superbly well-spent," especially compared to the millions that Pitney-Bowes

Continued on page 32

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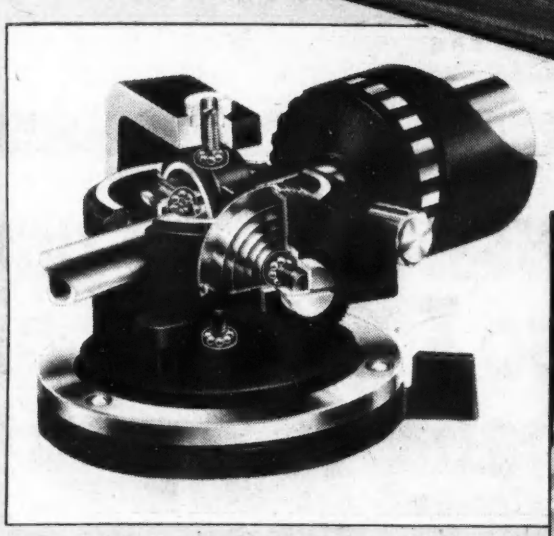

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ADVENT

Continued from page 29

spends to develop a new office machine or Zenith pours into a slightly different color TV tube. "A total expenditure absurdly small for any industry of this type," he says. "But too large for Advent."

Advent couldn't manufacture sets fast enough to cover its costs. In 1975, though the company's sales figures continued to rise, Advent logged a deficit of nearly $3 million.

Advent executives had seen the deficit coming and tried to buy time. They borrowed from the Massachusetts Business Development Corporation, from their bank, from themselves. Peter Seamans, a member of the board and formerly the company's attorney, loaned Advent $200,000 in late 1974; Kloss personally borrowed close to $400,000 in 1974 and 1975, secured by Advent stock. It was all used to pay current operating expenses while Advent fought to crank up its delayed VideoBeam production.

By spring of 1975, however, some of Advent's suppliers would no longer extend credit and were shipping materials COD only. Advent owed millions in accounts over 90 days old.

In June, State Street Bank and Trust, Advent's principal lender, nervous about its substantial investment in the struggling firm, declared the company to be in default of loans of $1.6 million and demanded accelerated payment.

"The numbers speak for themselves," says Alexander Washburn, assistant vice president in corporate banking at State Street. "The condition of the company as reported by the auditors showed deficits in almost every category of the operation. I think State Street Bank took a very responsible attitude."

But to Kloss, the bank's demands for payment constituted betrayal. Kloss wanted his lenders to look at the company's deficit as he did — as an investment in an important new product. "They didn't believe that there was a going business here," he charges. "They were completely bewildered, and they wouldn't believe anything we said."

Business never stopped at Advent; there were never padlocks on the doors. But, clearly unable to meet the new payment schedules, Advent's management didn't know how far the bank might go. At the bank's insistence, Advent hired (and paid for) a consulting service to take over managing the company temporarily and to assess its prospects. When the Pace Consulting Group of Hartford arrived in June to operate Advent for four months, Kloss lost control of his company for the first time, but Advent's salvation and Henry Kloss's ultimate decline in power were imminent. Just days away from Advent's possible liquidation, Peter Sprague agreed in principle to make an investment in the faltering business. By July, the Sprague takeover was official and public knowledge, though he didn't appear in person for several more weeks.

The Pace report to the bankers was encouraging. "We felt there was no reason in the world why it should not be a successful company," says Pace's Langdon Johnson. "The product had a great deal of promise." Pace recommended that the price of the VideoBeam be raised to reflect the cost of producing it. Advent management agreed and, that summer, the price increased in several steps from $2500 to $3700. Pace further recommended what Johnson calls "some basic changes both in its capitalization and in its operation." That's where Peter Sprague came in.

Sprague was 35 and already chairman of National Semiconductor, of Design Research Inc., and of Aston Martin, makers of the status-y British sports cars, all firms once on the verge of bankruptcy and now recovering. He'd also sunk portions of his inherited fortune into producing a movie, running for Congress, and a half-dozen other adventures.

It was attorney Peter Seamans who first proposed that Sprague embark on a new enterprise — bailing out Advent Corporation. Seamans called him last June 10; Sprague visited Advent on June 11, and sailed for Europe on the QEII with his family on the 12th. By his return he had decided to buy into Advent, and the lawyers, accountants and bankers wrapped up the deal in 24 hours. "Kind of a crazy thing to do," Sprague acknowledges now. "I'd never *seen* a VideoBeam."

The deal called for Sprague to buy 375,000 shares of common stock at $1.50 a share, a small fraction of the market price, plus warrants and options to purchase additional shares at the same price over several years. In all, Sprague, his business associates and members of the new management group made equity investments in Advent of $700,000. In return, Kloss agreed to sell or to place in a voting trust enough shares to give Sprague voting control over 44 percent of the company's stock for four years. So Kloss lost Advent for the second time, and probably for good.

He did not seem to realize it at the time. The press release issued in July of 1975 announcing the agreement and Sprague's elevation to chairman of the board stated that Kloss "will continue as its President and Chief Executive Officer."

But by September, only two or three weeks after Sprague had arrived, the new chairman had the various executives and department heads reporting directly to him and clearly had assumed control. He fired several top people and divided their jobs among his new management team. After a few months of running the firm himself, spending two or three days a week in Cambridge, he imported Pierre Lamond, a long-time friend and colleague from National Semiconductor, to be Advent's president at a minimum annual salary of $75,000. (Kloss had paid himself just under $60,000 that year.)

"The agreement was not for me to step aside," Kloss insists. He yielded, he says, because he had no alternative. Sprague, naturally, sees it differently, contending that though the agreement was made hurriedly, he always intended to run Advent and Kloss knew it. "Henry is not the world's best manager," Sprague says. "It was clear in my mind and clear from the numbers. That's why I asked for the voting trust, so that I could run the company in my way, not in Henry's way."

The two tangled repeatedly. Sprague initially offered to let Kloss continue with the title of chairman; Kloss demurred. "That would be a representation to the world I had an important input into policy, where in fact I had no say. I refused to make that representation," Kloss explains with pride. He maintains that Sprague violated an agreement that any new president would be subject to his (Kloss's) okay, and cast his board vote against hiring Lamond.

At any rate, both will agree that the purpose of the sale to Sprague has been accomplished. With the flow of new cash and new people, State Street Bank withdrew its demands and agreed to a deferred payment schedule. Finding the new management more "credible," it also loaned Advent an additional half-million dollars to help pay off suppliers. Sprague raised the VideoBeam price again, to $4000, and production, planning and accounting were reorganized. He also renegotiated a contract to sell VideoBeams in Europe and came up with terms that were a million dollars more favorable to Advent. A successful public offering of stock this past June raised $4 million more, to repay debts and secure increased bank credit.

Though Advent's losses continued into fiscal 1976, with a deficit of close to a million dollars for the first half, by midyear the turnaround was under

Continued on page 34

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Hanover
279 Main St.
Worcester
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ADVENT

Continued from page 32

way. The annual report shows that after losing nearly $3 million in 1975, Advent actually turned a $227,000 profit in 1976. It is, again, solvent.

What brought a successful audio components manufacturer to the brink in the first place?

According to Lamond, when the Sprague personnel began looking into the books they found that the audio products were only marginally profitable; some were actually losing money. "Basically, it was a break-even business," he notes, and adds that audio products and marketing had suffered from neglect during development of the VideoBeam.

Another cause of financial problems was Kloss's reluctance to lay off workers during the months of trying to rid VideoBeam production of its bugs. "By keeping too many people there too long, I lost a lot of money," he acknowledges.

"In the Henry Kloss organization, we tended not to plan for failure or retreat," agrees Jim Keith. "Most logical businessmen are very cautious and careful when they go into a new venture. The Henry Kloss machine was not. We just assumed it would be a success. We spent money like we had it."

Still, Advent might have prevailed had the VideoBeam been more realistically priced. Since it was conceived as a consumer product, though two-thirds of its sales have always been to restaurants, hotels and other institutions, its price was deliberately set as low as possible to attract customers. Kloss thought — still thinks — that five years from now 10 percent of all color televisions sold will be projection models, and he wanted the VideoBeam to have the first and biggest share of that market.

But $2500 was, he now admits, lower than possible. "They didn't know what the VideoBeam was actually costing," Lamond says, "or if they knew, they ignored it, and went along selling it for less than it was costing." In the spring of 1975, when the VideoBeam sold for $1700 wholesale, it cost $2700 to manufacture, so Advent lost $1000 each time a set was sold.

There was also the question of production, which continued to be balky and unreliable well after the first VideoBeams (the model 1000A) were on the market. When Ed Cobb, Sprague's new vice president and general manager, joined the firm, Advent was having trouble making its green tubes for the 1000A and was producing only as many VideoBeams each day as it had passable green tubes.

Sprague recalls that soon after arriving Cobb called him over, with Andy Petite and a few others, and showed them four sets. No one could tell the reject from the approved sets. It seemed the testing procedure was so rigid that a green tube which showed tiny flecks in an all-green image was rejected, although the flecks were invisible when the red, blue and green color images were superimposed, as in normal operation. With the test standards relaxed, production resumed and availability increased.

In Sprague's view, the decline of Advent stems from a simple deficiency — Kloss is a creative person but a poor manager who surrounded himself with other poor managers. The audio end of the business would probably have found a buyer, Sprague quotes the Pace consultants' report as saying, but with no investors interested in the VideoBeam, that project might have ceased to exist.

This, he says, is why he bought yet another failing firm. "When you see an innovative company, a company that's produced both a name and a product line, to see that go out of business because of what are really almost *counting* errors — either Henry didn't know or someone wasn't telling him and was busy selling the VideoBeam at less than it cost to make — that's a simple error. It's a shame to lose a business, when a lot of people have given their lives to it, because of that."

Kloss, however, is angered by the notion that Sprague/Lamond financial wizardry turned Advent around. "It was the sale of sets that really did it," he argues. "The money to get whole again came from operations manned by the people who had always been here. To view this as some sort of management miracle that turns things around is not a proper construct."

The Kloss creed is that products, not management, earn profits. "I've made money for 25 years in companies, and one year I didn't. The fact that the company makes money later, that's because the startup costs are over. You can't continue to promulgate the idea that there's something magical about management. Management doesn't make money, product makes money."

To Kloss, the villain is the State Street Bank. He believes that with the VideoBeam price already raised at the consultants' suggestion Advent would have turned around on its own if only the bank and other creditors had shared his faith in the TV and not called in their debts.

But would it? Washburn, the bank's account officer then, finds that view "not realistic. Anyone that's trained in looking at a balance sheet, and most bankers consider themselves trained, it would have red flags all over it. There were a lot of problems there.

"You need creative genius but you also need financial control. The trail of these creative companies is littered with collapses because you don't have both."

Sprague's reply is blunter: "No way. Not a chance. I realize Henry still believes that and believes the bank turned on him .... If the bank had loaned them another $2 million, and they'd left the price where Henry wanted it and continued operating the way they were, it would only have postponed the eventual bankruptcy of the company by six or nine months."

There *are* other ways to safeguard one's investment in a company and monitor results, short of a total takeover. Might another method have worked at Advent? Other Advent executives, past and present, take a tactful view of the question. Whether Advent could have saved itself without Peter Sprague's direct intervention is, they say, unknowable.

It has been a little over a year, now, since control shifted at Advent. About a year ago, Sprague called the Advent managers together and drew a blackboard diagram of how the company should function. He drew a box for himself — "Sprague." Beneath it he drew boxes for marketing, finance, and manufacturing, all reporting to him. And then, off to the right, apart from the other divisions, he drew a box for Kloss, labeled 'R&D."

One of the big changes has been this shift in people and jobs. Kloss was called "Director of Research and Development," but the 14 people in R&D actually worked for Kloss's colleague Frank Federman, who was called "Vice President of Research and Development." So Kloss, though he still sat on the Board and owned (but didn't control) the largest block of Advent stock, was effectively isolated. "He's been told to stay in the lab," Keith noted.

Kloss called himself "an appendage." He no longer had any role in operating Advent. "Technically, I'm free to make any kind of great new products in R&D," he said. "[But] I cannot spend one cent of the company's money. I can't sign a purchase order or a check. I have nobody working for me. I don't think it has to be quite like that." Lamond usually — but not always — approved his expenditure requests.

Other casualties included Advent's chief financial officer, fired on Sprague's first day as chairman, and senior vice president Stan Pressman, invited to leave several months later. Peter Seamans remains a director but the law firm in which he is a partner, Peabody and Arnold,

Continued on page 36

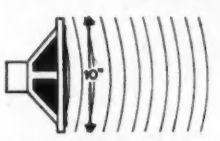
Introducing the Avid 101.

A rational solution to the problems of 2-way speaker design.

Designing a reasonably priced 2-way speaker system has always had its problems. One of the most perplexing of which has been engineering a speaker system with both well-dispersed midrange *and* really extended bass.

The bass vs. midrange dilemma.

In one respect, a 6 or 8 inch woofer is preferable for a 2-way speaker system because its small diameter affords better dispersion in the critical midrange area up to the crossover point where the high frequency driver takes over.



Conventional 10" woofer is directional in midrange.

8" woofer affords superior midrange dispersion.

But, a small diameter woofer just isn't capable of handling the power required for really extended bass (say to 30 Hz) in traditional designs without the use of costly electronic equalizers.

A real dilemma. The best solution to which we feel lies in a unique new 2-way speaker system—the Avid Model 101.

A rational solution.

The Avid 101 overcomes the traditional bass versus midrange dilemma through an unusual combination of a large vented enclosure and a specially engineered 8 inch woofer.

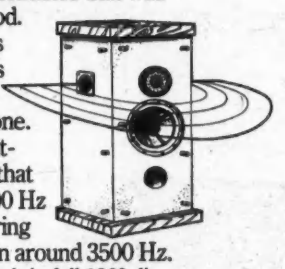
Unlike conventional vented designs, the Avid 101's vented enclosure is used to *extend the bass response* of the system, rather than to increase the efficiency. This unique design (essentially a 4th order Chebychev filter alignment) achieves really extended bass—*down 3 dB at 30 Hz*—while the use of an 8 inch woofer insures a smooth, well dispersed midrange up to its 2500 Hz crossover point.

Of course, no ordinary 8" woofer could do the job. It took us over a year to perfect the woofer design and it's quite unique. For example, it utilizes an unusually large magnetic structure and a specially developed rubber-edged cone of almost twice the weight and stiffness typically used.

But you have to actually listen to the Model 101 to really appreciate just how well it solves the traditional problems of the 2-way speaker.

A high end to match.

Things just wouldn't be complete if we didn't give the 101 a high-end performance that was every bit as good.



Which is why the 101 has three tweeters instead of just one. A primary, front-facing tweeter that comes in at 2500 Hz and two side-firing units that kick in around 3500 Hz.

The result is full 180° dispersion in the high end all the way up to 15 kHz for a sense of imagery and openness which, until now, was unavailable in all but the highest priced speakers.

The right choice for most listeners.

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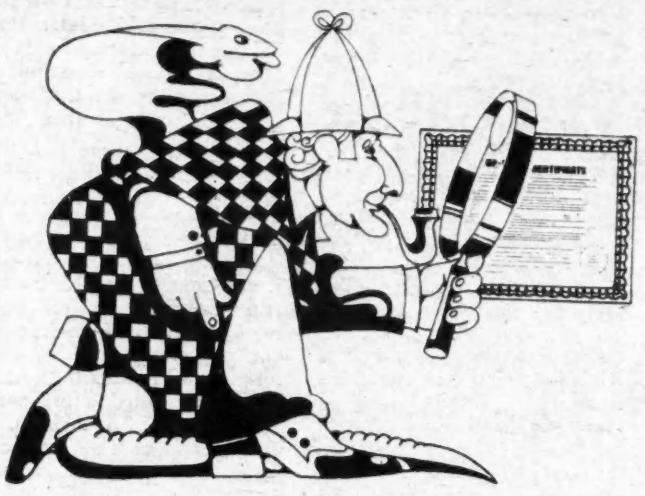

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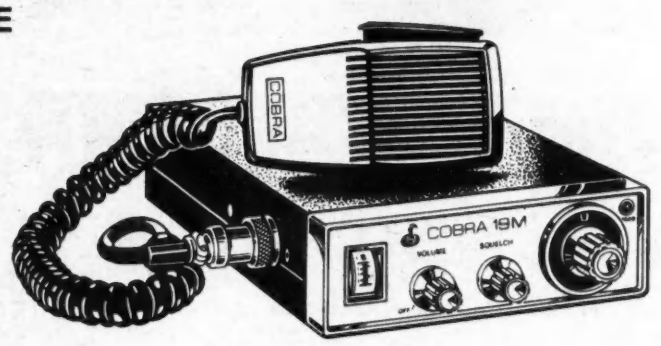

COBRA 29 MOBILE

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- Maximum legal power
- FCC type-accepted

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433 Maple Street

MAYNARD & HUDSON
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MALDEN
Eastern Auto Parts
182 Eastern Avenue

MALDEN
Malden Jewelers
27 Pleasant Street

ADVENT

Continued from page 34

was replaced as Advent's general counsel. Vice president Fred Goldstein, acting marketing director after Pressman left, became director of the Longy School of Music in Cambridge (though he remains a director and part-time employee at Advent). There are new faces, and new jobs for old faces.

Jim Keith, for instance, was reduced from director of all manufacturing to head of audio operations only. "It's been a very disappointing experience for me," he admits. "There were 25,000 square feet of facilities when I took over manufacturing operations. Since 1969 we've grown to 250,000 square feet. I directed the buildup of that operation, the staff and management. The disappointment is that in the reorganization a fellow like myself does not wind up with the same responsibility."

Keith says he is not surprised — he and a number of other Advent people went through the same sort of upheaval when Singer bought KLH. It's part of what Kloss calls "the tendency to reject the judgments of people here — myself most massively, of course — and lots of other people . . . . After you observe a company, you realize some people *do* have some ability."

Sprague concedes the point without apologies. "When you go in the first day, you know that one, you know nothing. Two, it's in trouble. Three, you've got to do *something*." He adds, "The one thing you can't do is maintain the *status quo*."

No one will accuse the new management of that. Along with the people, the policies have shifted as well. Some changes are small, if symbolic. Whereas Kloss paid little attention to when employees arrived or left, Lamond noticed the marketing staff trickling in from 9:15 to 9:30 and ordered them to begin the work day on time, at nine. "An example of the old saying, 'A day's work for a day's pay,' " he explains.

David Krathwohl

Wiring VideoBeams in Cambridge.

Advent's contribution to the WGBH auction was another example. The company traditionally gave the educational station several thousand dollars' worth of audio equipment and, for the past two years, a VideoBeam. It was both a commitment to Channel 2 and a thank-you for the use of the station for certain experiments. This year, Lamond ruled that a tabletop FM radio would be a sufficient donation.

More significant, the process by which management decisions are made is altogether different. Kloss and his key people held marathon, five-hour dinner meetings every Monday for intense policy discussions. In between, he preferred to leave them alone. "This idea of very few people working with a lot of freedom, that's a very pleasant way to run a business," he reflects.

But it's not the way Lamond runs a business; he keeps tight reins on everyone, signs every purchase order himself and insists that staffers justify their expenses. "I want to make people very aware of the fact that this is a very competitive business with very small profit margins," he explains, "and you have to be very penny-conscious."

There may be a change, too, in the Advent products themselves. No one knows this, yet, but with Kloss uninvolved in the process of defining hew products, it's a possibility. "It seems as if marketing has a bigger voice than it has had in the past," Andy Petite thinks. Instead of intense dialogue between marketing and engineering — chiefly Pressman and Kloss — there are more formal procedures, meetings, schedules.

This might have happened anyway, though. For the most profound changes at Advent Corporation will be the result not of new policies, or even of new management, but of size. As an audio company in a domestic market where no components manufacturer claims more than seven or eight percent of the units sold, Advent might have remained a small, chummy company in Cambridgeport. But the day it decided to mass-market television sets, to compete with the RCAs and the Zeniths and the Sonys, it also elected to grow.

The distribution of the new VideoBeam 750, a less complex and slightly smaller consumer model which retails at $2500, will not be restricted to a few specialty outlets. It will be sold in department stores, appliance stores, chain stores. Now being test-marketed in seven cities, it will be the subject of a larger advertising campaign than Advent has ever mounted. Audio is growing too, with five new products slated to be introduced this winter and spring, more than Advent has ever marketed in a year.

Furthermore, for the first time, Advent has turned to "offshore assembly," using a subcontractor in Mexico, where labor costs at least a dollar less an hour. It's another of Lamond and Sprague's cost-cutting attempts, which they believe necessary to compete with Japanese audio and video imports, which are assembled on Taiwan.

"Crazy old Advent," says Sprague rather fondly. "California was practically a foreign country. We did no business abroad. We made everything in the VideoBeam ourselves."

When Sprague talks of the company's future, he's talking about another 30,000 to 50,000 sets sold each year, another $45 to $75 million in sales. Within a year, Sprague says, Advent will have a factory in Europe. Within a year, Lamond adds, Advent will have an assembly and warehouse facility elsewhere in the US to bring it closer to markets in the South and West.

Some businesses, like makers of scientific instruments, can remain small Cambridge companies and survive on narrow markets, Sprague lectures. But not VideoBeam manufacturers.

"Maybe [British economist Ernest] Schumacher has a point that small is beautiful," he says. "Maybe that's a better way of life. But I don't think you can go into the consumer products market in this country and be small. If consumers want what you're selling, you have to be larger. And if they don't want it, you're not in the consumer market."

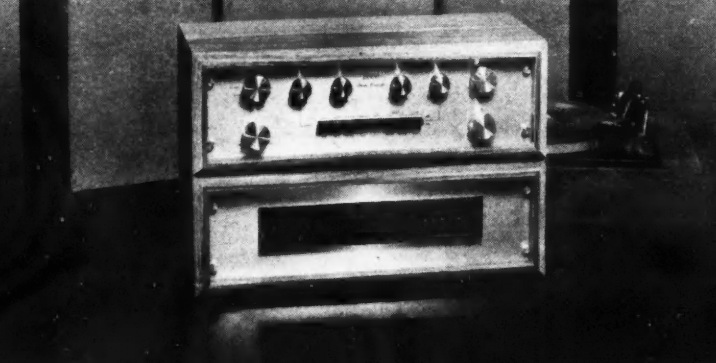
There are fundamentally different views of success at work here. Sprague points to Kloss's pride that Advent introduced a cassette recorder that incorporated the British "Dolby box," which virtually eliminates background noise. It was such a good product that other manufacturers copied it, and the Advent Model 201 Tape Deck now commands only four percent of the market and is only marginally profitable. Sprague thinks that something this innovative should have 25 percent of the market, not four. Four percent is not, to him, success.

"I didn't force my way into Advent," Sprague says. "The deal was made and Henry knew he'd lost control. He has gone from close to personal bankruptcy to being worth $7 million, on paper at least. That's not the worst thing that can happen to you. And yet I'm sure in Henry's mind there's a feeling of being ripped off. It's just too bad." It puzzles Sprague that someone capable of putting together a VideoBeam would even want to confront the day-to-day headaches of a business person.

As for Kloss, this summer he spent 10 days on the Vineyard, his first vacation in five years. He said that it was something of a relief to turn over command of Advent — it had its positive aspects. He said he was not interested in resisting change or causing trouble.

But such diplomatic statements were overshadowed by other, less gentle ones. He clearly felt defrauded and deceived. "Instead of the whole arrangement with Peter Sprague being an addition, as I in my fond hopes thought, it turned out to be a complete replacement," he said.

Introducing the Phase Linear System 200



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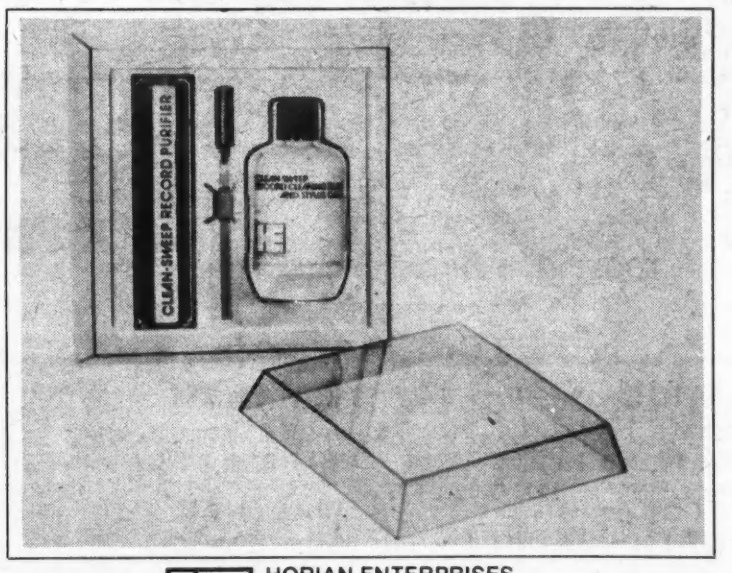

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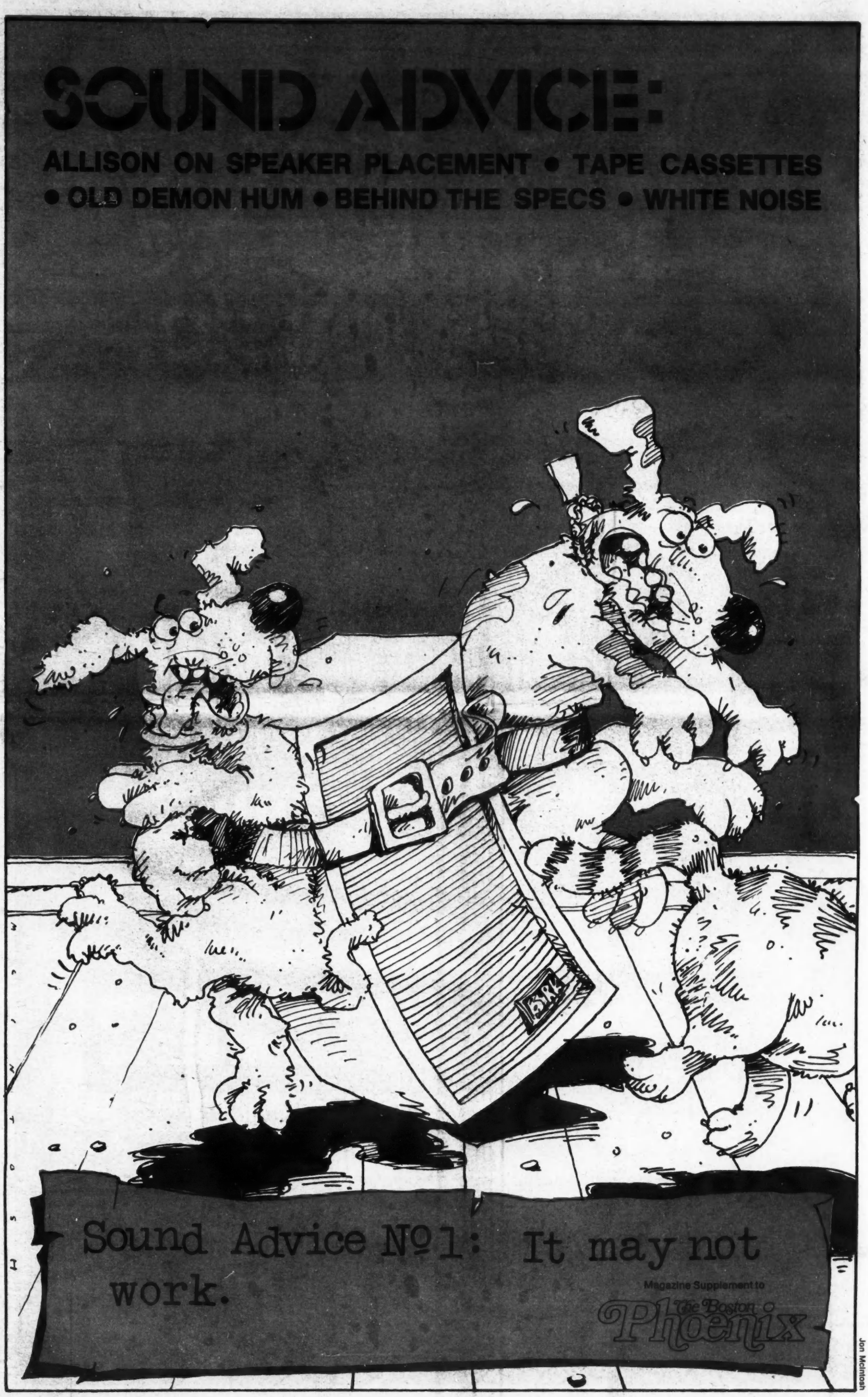
ALLISON ON SPEAKER PLACEMENT • TAPE CASSETTES • OLD DEMON HUM • BEHIND THE SPECS • WHITE NOISE



Magazine Supplement to
The Boston Phoenix

Jon McIntosh

What you don't hear is as impressive as what you do.

Up to now the most you could expect from a medium-priced cassette deck was rather medium performance. But now there's the RS-630US. The medium-priced cassette deck with high-priced performance.

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*Dolby is a trademark of Dolby Laboratories, Inc.
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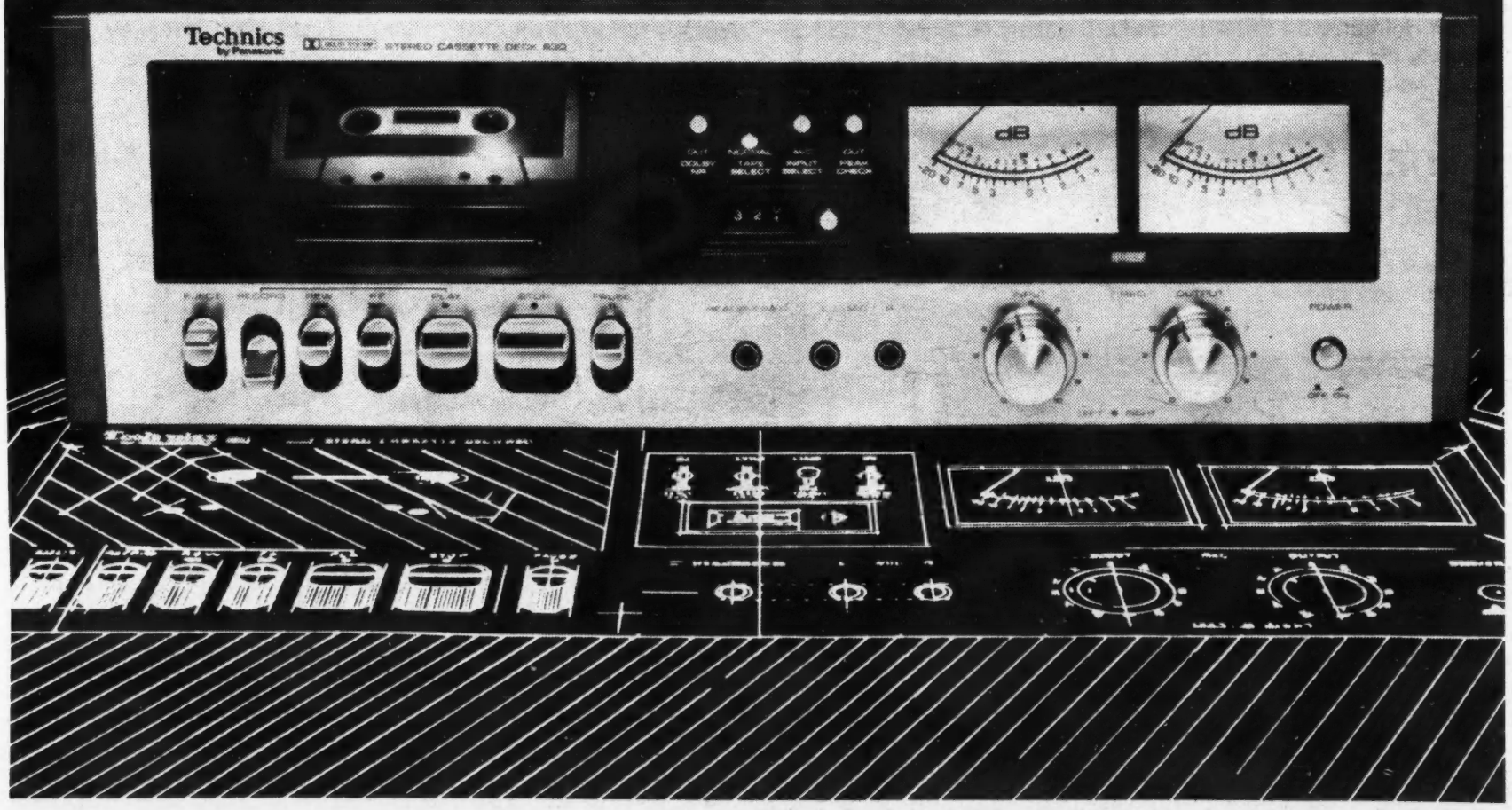

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Roy Allison

Roy Allison, president of Allison Acoustics in Natick, is well-known for his extensive research in the area of room boundaries and loudspeaker frequency response. This sampling of his wisdom — complete with graphs — is reprinted from the August, 1976, issue of *Stereo Review*, copyright Ziff-Davis Publishing Company.

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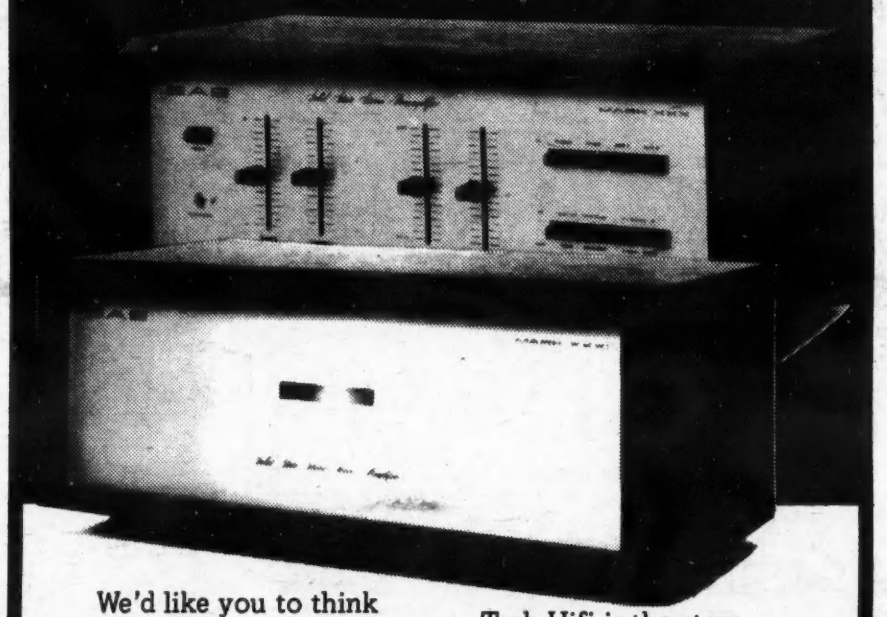

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NO, YOU DON'T PUT THEM IN CORNERS

Possibly the last word on speaker placement

by Roy Allison

A newcomer to high-fidelity sound reproduction soon discovers that the sound of a given speaker system is profoundly affected by the acoustical characteristics of the room in which it is being used. Not quite so evident, however, is the fact that there are also significant, audible changes in frequency balance as the position of the speaker — or of the listener — changes even slightly in the room.

The effects of all these variables have often been touched upon in a general way in articles dealing with room size, construction materials, and furnishings. Only recently, however, has it become possible to develop quantitative data on two important aspects of the complicated speaker/room/listener relationship. First, if a speaker system's position with respect to the nearest three room boundaries (two walls plus the floor or ceiling) is known, the room's effect on the speaker's acoustic power output can be predicted quite accurately. Second, at least a close approximation of the way room boundaries affect the sound field at various *listener* locations can also be calculated if we know the distance of the listener's head from the nearest three room surfaces.

When sound is fed into a room, it reflects successively from one room-boundary surface to another. This effect is known as reverberation. In those areas that are only a small fraction of a wavelength away from such a boundary, the direct and reflected sound pressure are in phase, and therefore combine by simple addition. For an area close to any one room surface but not to others (such as the center of a large wall), the maximum increase in sound pressure above that measured in the middle of the room (assuming that sound energy is arriving at the boundary equally from all directions) is three dB. (Note that in all our examples we are assuming that the sound field is diffuse — that is, it reaches the boundary after having been reflected from all directions.)

If the listener moves farther away from the reflecting surface (or if the wavelength is decreased, by making the frequency higher), the reflected sound energy will eventually arrive back at the observation point opposite in phase to the direct sound, causing the sound pressure at that point to be about one dB lower than it is in the middle of the room. This pressure minimum occurs at a distance of 0.35 wavelength from the boundary. Beyond that distance the effects of the boundary are minor. A speaker system's acoustic power output at low frequencies is in direct proportion to the resistive load presented by the air surrounding it, and this load depends on the speaker's proximity to room boundaries. The measured effect of this loss on a speaker's power output is of precisely the same magnitude as the audible variation in sound pressure for listeners near room boundaries. There is, however, no dependence on a diffuse field in the room, because the speaker's output at low frequencies is omnidirectional.

Near the intersection of *two* room boundaries the additive reflections can increase the sound pressure by a factor of four, or a maximum of six dB. And the sound pressure at a location that is only a small fraction of a wavelength distant from a *three*-boundary intersection (two walls and a ceiling or floor) is increased nearly eight times by the multiple in-phase reflections, for a maximum boost of nine dB. Thus the gain in sound pressure at very low frequencies is inversely proportional to the solid angle represented by nearby listening-room boundaries.

This proportionality does not, however, hold for the maximum reduction in sound pressure at the observation point which occurs when reflections are in phase opposition to the direct sound. At a single boundary (wall, floor, or ceiling) the sound pressure is reduced by one dB, as we have seen. But at a point approximately 0.3 wavelength distant from two intersecting room surfaces, the sound pressure reduction is three dB, and at about 0.3 wavelength distant from a three-boundary intersection the reduction is 11 dB!

This phenomenon has severe audible consequences. If a microphone (or a listener's head) is located close to and equidistant from a three-surface room corner, the sound pressure will vary over a range of 20 dB (+9 to — 11 dB) as the audio signal frequency (and hence the wavelength) changes, although the sound pressure in the middle of the room remains constant. Fortunately, the variation is less for locations off the line of symmetry from the corner, but it is still of considerable magnitude.

These relationships were first spelled out in several papers by scientists at the National Bureau of Standards. The mathematical operations required to plot a "response curve" for a particular speaker or listener location are tedious, but a large computer, properly programed, can make short work of the dreary calculations. The curves presented with this article were plotted from data supplied by such a computer. They are of two kinds: first, there are speaker power output *vs.* frequency curves showing how the calculated power output of a standard "ideal" speaker system changes as its position in the room is varied. Second, there are curves showing the additional influence of room boundaries on the sound heard by listeners sitting in typical positions in a room. In addition, there are a few curves showing the result of combining a speaker's response for a particular room location with a specific listener position.

The theoretical basis for predicting a listening room's influence on speaker acoustic-power output has been tested experimentally and found to be applicable to real home listening rooms and speaker systems. Therefore, the loudspeaker/room curves shown herein can be relied on completely. Somewhat less confidence should be placed

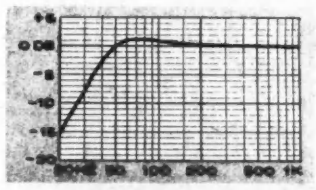
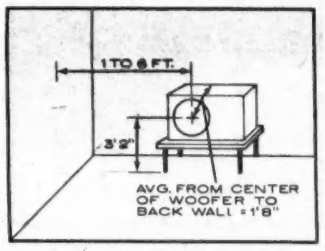


Fig. 1. Relative power output vs. frequency for a "standard" speaker system with a 50-Hz bass resonance. This is a normal anechoic performance for many current speaker systems.



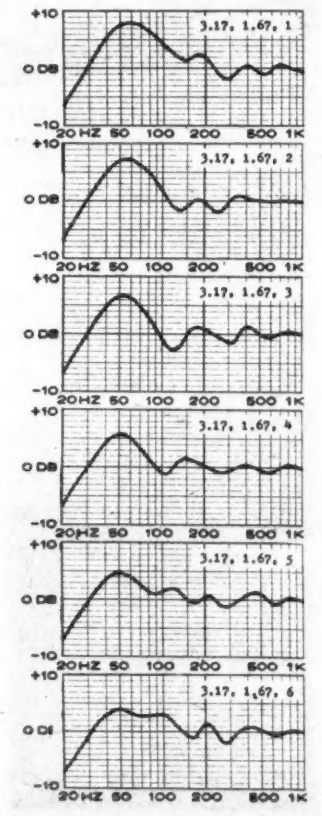
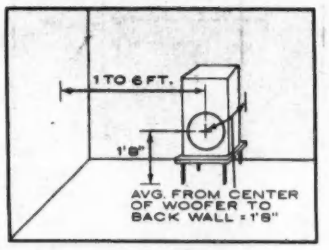


Fig. 2. Power output vs. frequency for same speaker (Fig. 1) as measured in a typical listening room. Numbers on charts show distances (in feet) from center of woofer to the floor, to the back wall, and to the nearest side wall.



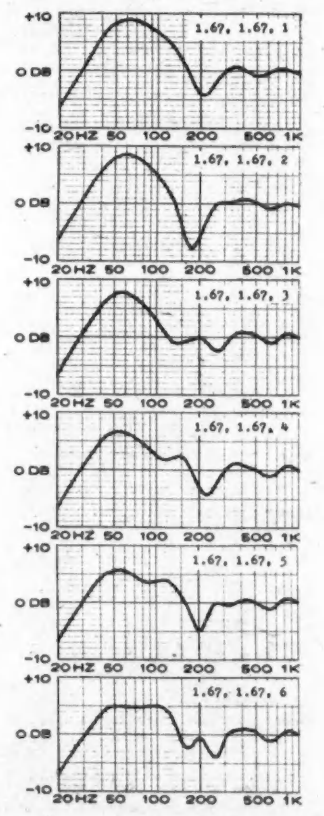
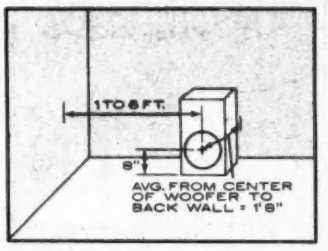


Fig. 3. Standard system placed on a base or low table about one foot high with the woofer end of the cabinet down, the back near the rear wall, and the distance to the side wall increasing in one-foot increments.



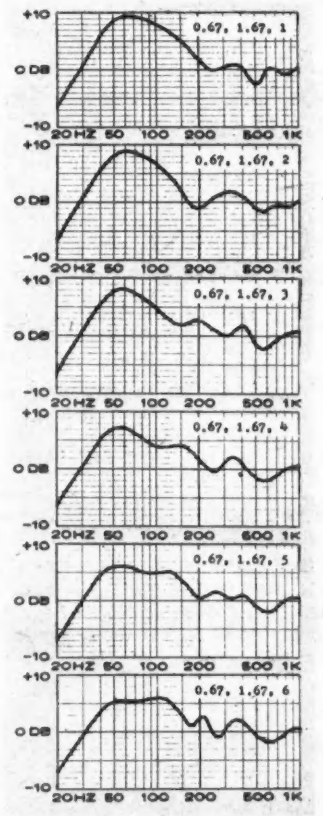
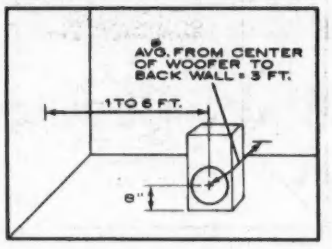


Fig. 4. Response in real room for standard system with the woofer end of cabinet on the floor, back close to the rear wall, and at one-foot increments of distance from a side wall.



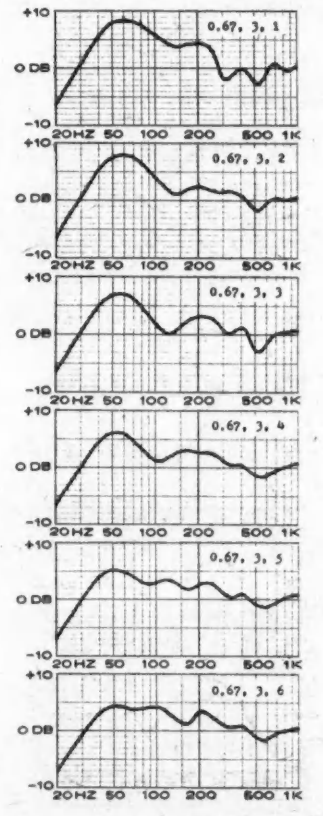


Fig. 5. Same room, same system. Here the woofer end is on the floor and the distance to the rear wall is three feet. Response changes radically as the distance to a side wall is increased incrementally from one to six feet.

in the listener-position curves, however, since they assume a totally diffuse sound field such as might occur in a concert hall, and the home listening room suffers from resonance modes (standing waves), which are directional and, in a small room, usually widely spaced in the low-frequency range. However, with the usual listener locations, the resonance modes tend to coincide with and to reinforce the normal boundary effects at listener positions.

Speaker position

To show how speaker output is affected by a real room, it is convenient to start with a "standard" or reference speaker. Figure 1 is a power-output *vs.* frequency curve (measured in an anechoic chamber; a near-field response measurement would yield the same curve) for a hypothetical "standard" speaker. The performance and the physical arrangement of the system are quite close to those of many high-price bookshelf units now on the market. This hypothetical system has a cabinet with dimensions of about 1 x 1 x 2 feet, and its woofer is mounted toward one end of the front panel. The system's normally damped bass resonance is at 50 Hz. (Although this hypothetical system is an acoustic-suspension type, the design principle is not relevant. The room effects to be shown would apply to any type of speaker system except those using bass corner horns; only the distance from the driver to the three nearest room boundaries is important.)

Suppose we take this standard speaker system into a home listening room and put it on a 32-inch-high table or shelf, with its back close to the wall. The center of the woofer will be 3.17 feet from one room boundary (the floor), and its average path length along the exterior surface of the cabinet to the rear wall will be about 1.67 feet. Figure 2 is a family of acoustic power-output curves obtained as the system is moved gradually away from the side wall, with its center at distances varying from one to six feet. It is evident that as the distance to the side wall is increased, the peak in output centered at 50 to 60 Hz decreases. In fact, the six-foot side-wall spacing causes an output variation from normal of only about + or — 3 or 4 dB. None of the curves looks exactly like the system's *anechoic* curve, however, and in most domestic rooms it would not, of course, be feasible to locate a stereo speaker six feet or so from the nearest side wall.

If we take the speaker off the shelf and put it on a one-foot base or stand with the woofer end of the cabinet at the bottom, the woofer's center will be roughly 20 inches or 1.67 feet above the floor. Its average path length to a rear wall remains 1.67 feet if the cabinet back is placed close to the wall. Adjusting the base location so as to vary the distance to the side wall, we obtain the family of curves shown in Figure 3. It is obvious that the bass peak here is greater than for the corresponding shelf positions. Also, the fact that the woofer remains at the same distance from two of the boundaries tends to "pull" the acoustic power dip toward a common frequency (200 Hz) for all the curves and to make its average severity greater than would be the case for unequal distances. It is rarely a good idea, therefore, to stand a speaker system on a short base.

The curves in Figure 4 are similar to those in Figure 3 except that the woofer end of the cabinet now rests on the floor. As a result, the 1.67-foot woofer-center distance of Figure 3 becomes 0.67 feet (eight inches), with a resulting improvement in overall smoothness. The suck-out at 200 Hz is now gone. A study of the three sets of curves shown so far does, in fact, suggest a useful rule of thumb for the installation of conventional speaker systems: *the more different the distances from the woofer to the three nearest room boundaries, the smoother the acoustic power-response curve will be.* This rule is verified in general by the set of curves shown in Figure 5. We have left the woofer end of the cabinet sitting on the floor but have moved the system forward so that the woofer is about three feet from the rear wall. Again, curves are shown for six different distances up to six feet from a side wall. The most irregular curves (aside from the 50- to 60-Hz bass peak) are those for which two dimensions coincide or are quite close.

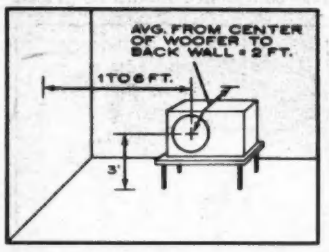
Figure 6 shows the result of positioning the system on a pedestal somewhat away from the rear wall. The woofer is assumed to be three feet above the floor and two feet from the back wall, and the speaker is again moved varying distances away from a side wall. Some of the power curves are relatively smooth, particularly those at greater distances from the side wall. When two dimensions coincide, however, as at the three-foot distance, there are larger variations. (It should be made clear that the same results would be obtained if we kept the woofer's center two feet above the floor — or two feet below the ceiling — and three feet from the rear wall. It is the *combination* of distances that matters.)

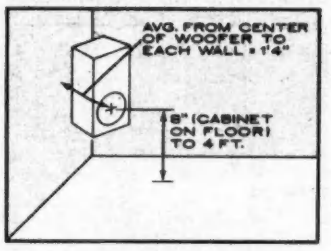
Next, if we install this standard speaker diagonally across a wall intersection, the distance from the center of the woofer to each wall will be about one-and-a-third feet. Power response in this case is very uneven no matter how far the system is raised above the floor, as Figure 7 shows. A corner is therefore *not* a good place to install any system *not specifically designed for it.*

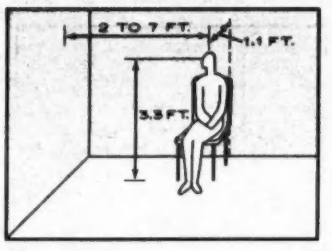
Listener location

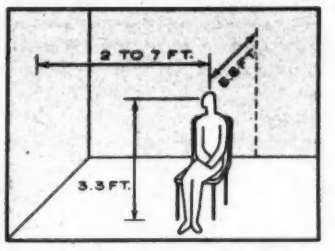
In most domestic listening rooms there are fewer practical choices for locating the listener than for locating the speaker. For example, few audiophiles, however dedicated, would be comfortable sitting on a mid-wall shelf. Also, the height dimension is virtually constant since a seated listener's ears will hardly ever be less than 36 inches and never more than 42 inches above the floor. For our

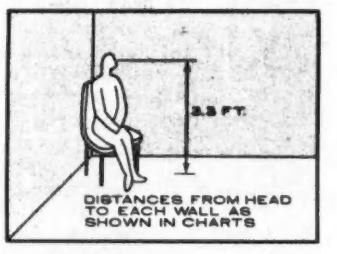
Continued on page 42











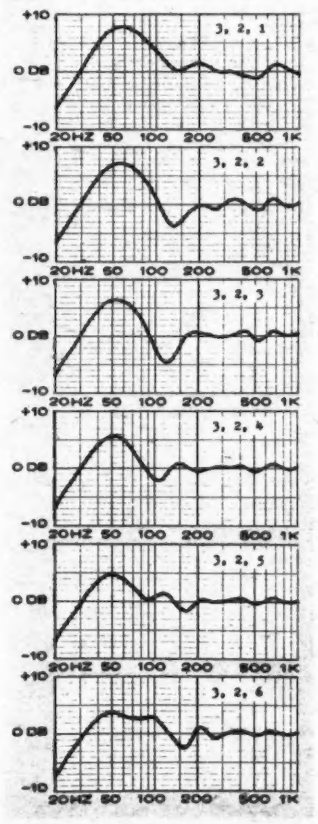


Fig. 6. *The standard box's real-room response when the woofer is three feet above the floor, two feet from the rear wall (or vice versa), and at one-foot increments of distance from the side wall.*

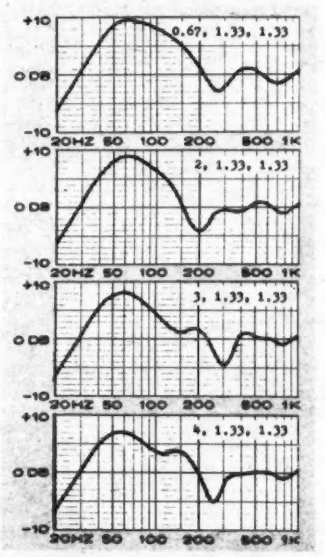


Fig. 7. *Cater-corner placement of the standard system produces the output curves shown at four distances of woofer center above the floor.*

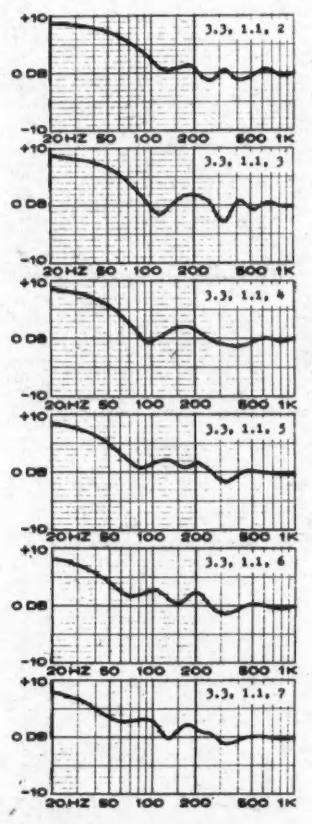


Fig. 8. *Room-boundary reflections also alter sound-pressure at listener locations. Curves show boundary augmentation for a listener seated close to one wall and at various distances from another. Curves plot sound pressure against frequency if a diffuse, uniform sound-field existed in the middle of the room.*

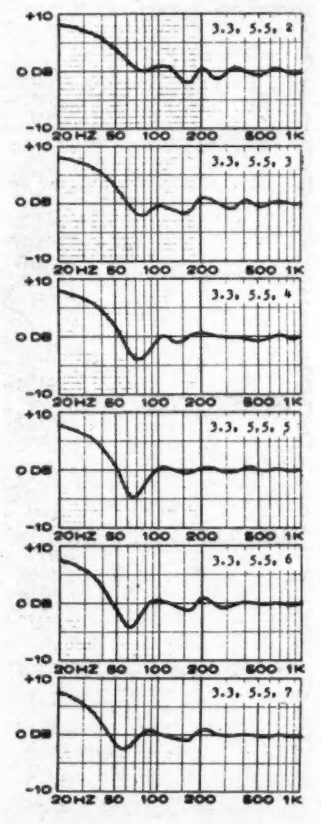


Fig. 9. *Boundary effects on sound-pressure for listener seated five-and-one-half feet from one wall and at one-foot increments from a side wall.*

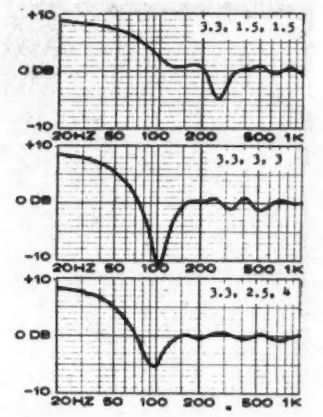


Fig. 10. *Effects of room-boundary reflections on the sound-field for a listener seated close to a corner. Height is constant at 3.3 feet; other dimensions shown are distances to nearby walls. Note huge variation when the three distances are nearly identical.*

RATING THE HI-FI MAGAZINES

A critical review of the reviews

by Larry Collins

For a hundred dollars or so a year you could spend all of your spare time reading about sound instead of listening to it, for the popularity of stereo component systems has brought with it a boom in the magazine publishing business. We present herewith, then, a rough guide to what's between the glossy covers. (For a lengthy, specific discussion just of the three major magazines' classical music critics, see the *Phoenix* music supplement of April, 1975.)

Stereo Review

With a monthly circulation of about 450,000, this is the Big Daddy of the slicks, the most popular magazine in the field. Since the mid-'50s, when it was called *Hi-Fi/Music Review*, it has consistently reflected the dual interest of component audio users in both music and the equipment used to reproduce it. Its success is attributable to a two-pronged editorial policy that, though not explicitly stated in the magazine, is plainly evident in its contents:

First, more than any of its competitors, *Stereo Review* extends in its pages an open-arms welcome to new readers, to novices buying their first audio components, and to those just beginning their record collections. This attitude is evident in the feature articles — profiles of popular and classical musicians; introductory surveys of various genres of music; tutorial guides to buying turntables, cassette decks, etc; instructions on selecting and caring for components. It is expressed even more strongly in the service features — *e.g.*, "Audio Basics," a continuing explanation of hi-fi terms, and the "Basic Repertoire," a generally reliable critic's introductory survey of the recorded performances of 100-odd basic classical pieces.

The classical reviews, by a handful of widely varying critics, usually manage to avoid the stuffy elitism which pervades much writing on classical music, and the equipment discussions usually manage to lighten the weight of technical jargon, which would be a burden for novices. The magazine is always teaching, trying to broaden and deepen the reader's involvement with the equipment or the music. That this formula inevitably helps the magazine's advertisers adds to *SR*'s successful position.

Second, the other element in *SR*'s formula is simply that *Stereo Review* is the most thoroughly edited magazine of its type. Actually, this is both a limitation and a virtue. The limitation is that the editing imposes on authors a too-obvious uniformity of style; the individual's personality and idiosyncracies, as reflected in his or her use of language, often does not survive the process. Judgments expressed in an article usually reflect the views of the magazine's editors as well as the author of the article — or, occasionally, the view of the editors *instead* of the nominal author.

The virtue of this sort of rigorous editing is an exceptional record of technical accuracy and clarity. Historically, *SR*, in its articles, columns, and equipment reviews, has committed fewer technical blunders and has imposed on its readers fewer misleading notions than any of its competitors.

The two people responsible for this are technical editor Larry Klein and equipment reviewer Julian Hirsch. In a field where every design change is hyped as a major breakthrough, the genuinely useful improvements and innovations which are taking place can be hard to spot, but Klein and Hirsch clearly have made that one of their goals in the magazine.

Success is also a prison. With its large circulation, the monthly can charge very high advertising rates, so it operates on a huge annual budget. This means an offense to an advertiser is an expensive mistake. The reader's subscription or newsstand price pays for only distributing the magazine; the advertisers pay for everything else, so the magazine is inevitably committed to serving them as well as the readers. For example, derogatory reviews of products never make it into print. Hirsch's published opinions of components range from moderately favorable to extremely favorable, but never unfavorable. When Klein and Hirsch decide that a component is a dog, the review is canceled and they suggest to the manufacturer that the product be improved. (For more details on *SR*'s reviewing philosophy, see the interview with Julian Hirsch in the *Phoenix* HiFi supplement last March.)

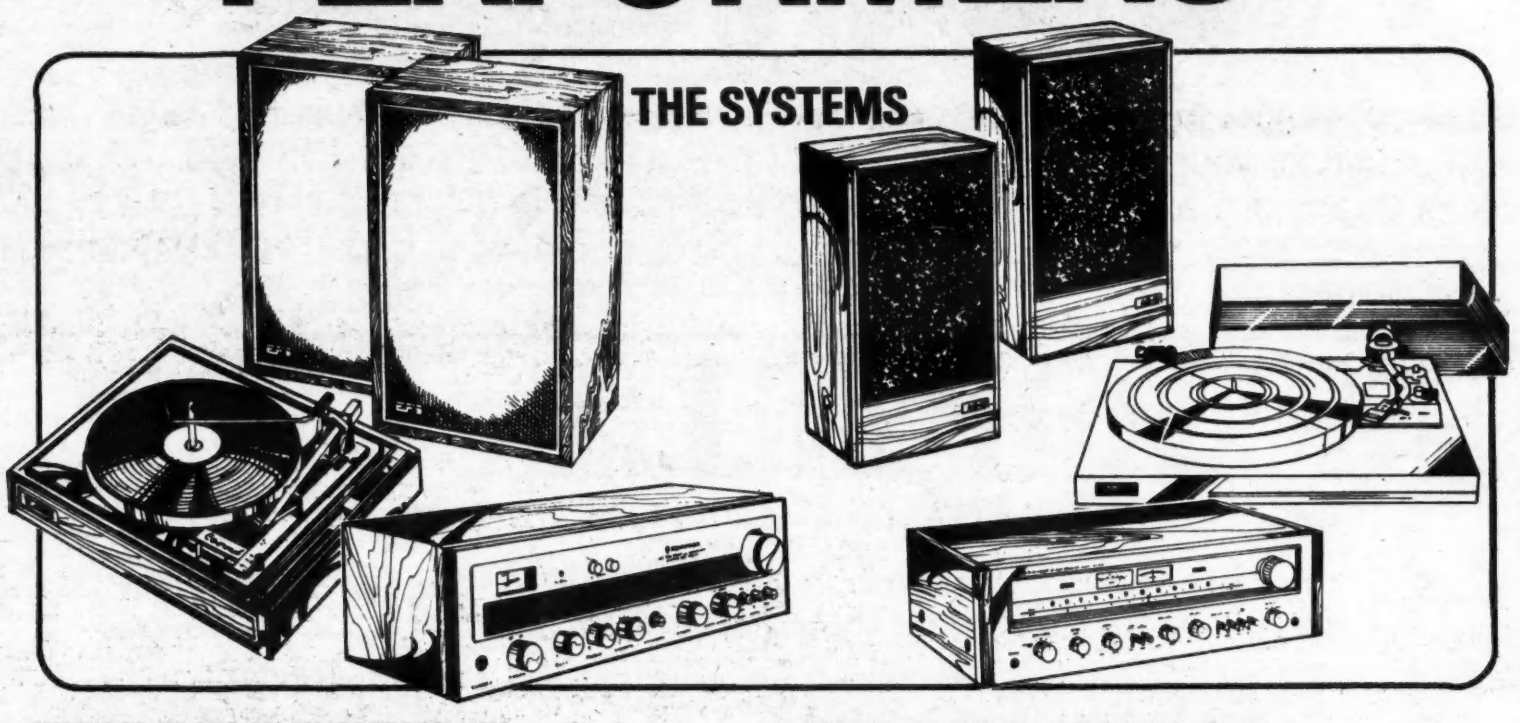
Popular Electronics

Monthy circulation, 400,000 copies. *P-E* really doesn't belong here, since it is about hobby electronics in general, not primarily about audio. But it contains two features of interest: "Stereo Scene," a frequently informative column by Ralph Hodges (assistant technical editor of *SR*), and equipment reviews by Julian Hirsch. Some of

Continued on page 44

SAVE ON THE TOP-NAME SOUND PERFORMERS

THE SYSTEMS



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PIONEER SX-650/AR-14/TECHNICS SL-20/ MUSIC SYSTEM-Probably all the music system you'll ever want. It features the new AR-14's with definitive base and shimmering highs you must hear to believe. The new Pioneer SX-650 AM/FM receiver with 35 watts RMS per channel, (20Hz-20Khz, 0.5% THD at 8 ohms) and the Technics SL-20 table is complete with base, hinged dust cover and Empire XL-15 31E cartridge.

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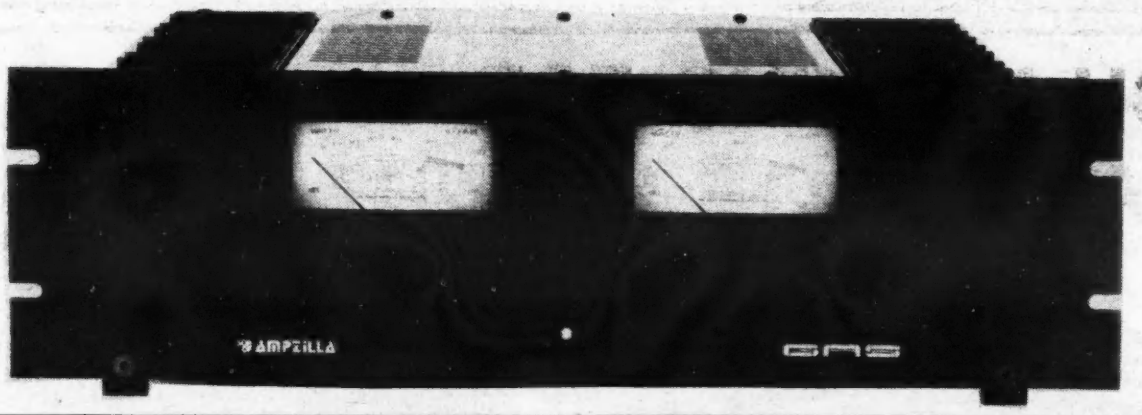

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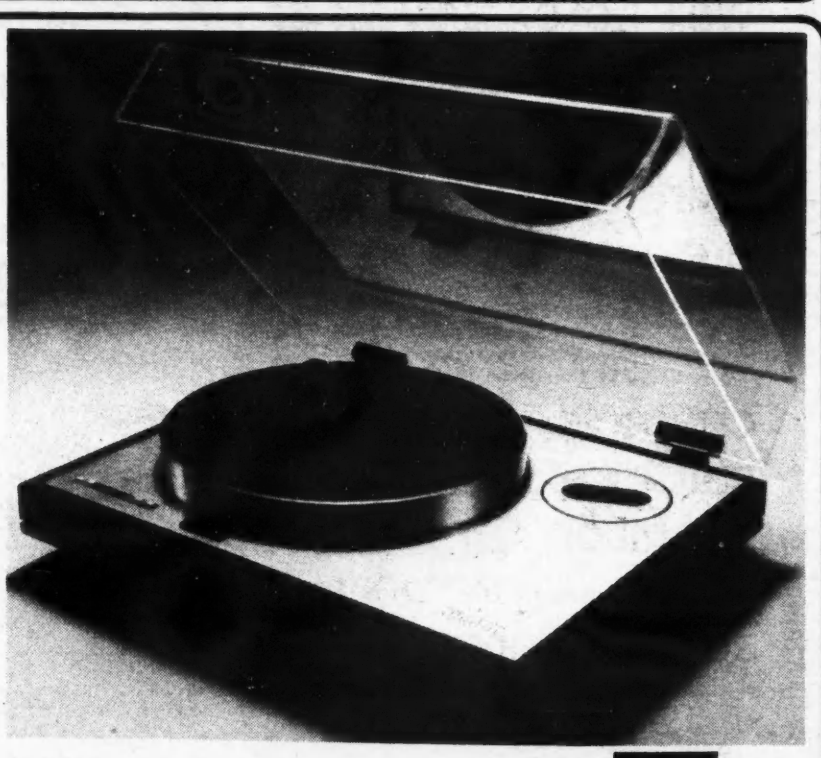

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A Totally New Kind of Audio Component

Audio Pulse
DIV. OF HYBRID SYSTEMS

The Audio/Pulse Model One is a radically different audio component that recreates the feeling of being there. It can make a living room sound like a concert hall or cathedral or theater or nightclub.

When you hear what it does, we think you will agree it is the long-awaited major step toward totally realistic sound reproduction.

It is the first of an entirely new breed of audio equipment, and its sophistication goes beyond any product we know of in its planning stages elsewhere. It uses the equivalent of 150,000 transistors (90 integrated circuits) for highly advanced fully digital processing of audio signals. With conventional solid-state techniques of a few years ago, it would have to be as big as the kitchen in an average home; with tubes, it would be at least as big as a concert hall. Yet it is simple and enjoyable to use — *and requires no special program material.*

The Model One is essentially a minature computer programmed with a flexible electronic model of acoustic space. It adds multiple time delays to the sound of a record, tape, or broadcast. The delayed sounds are fed to a separate amplifier and heard over a second set of speakers (which don't have to be big or ultra-wide-range) to the sides or rear of a listening area. And the delays are recirculated and cross-coupled between stereo channels to reproduce the many ways in which sounds bounce, reflect and blend in a large public space.

The Model One's flexibility lets you make anything from a single guitar or singer to a rock band to a full-size symphony orchestra sound as if you are hearing it in its natural setting.

We believe you will find it a tremendously useful and enjoyable piece of audio equipment — and will be delighted to find that it not only doesn't require anything beyond a conventional stereo program source but also will come surprisingly close to its full effect with *mono* recordings and broadcasts.

What it really is and does has to be heard.

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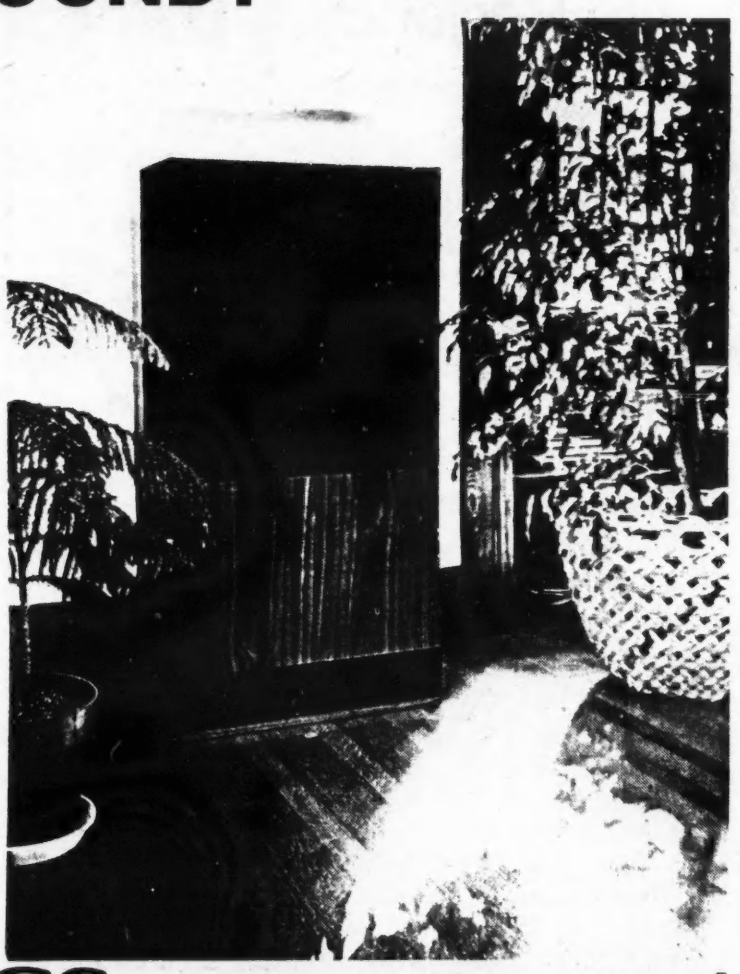
The SNELL ACOUSTICS Loudspeakers may very well be exactly what you've been looking for.

Not only is the direct sound extremely clean and accurate, but the reverberant energy in a room is as smooth as possible, these characteristics together result in exceptional imaging, definition, and depth; providing extremely realistic sound reproduction.



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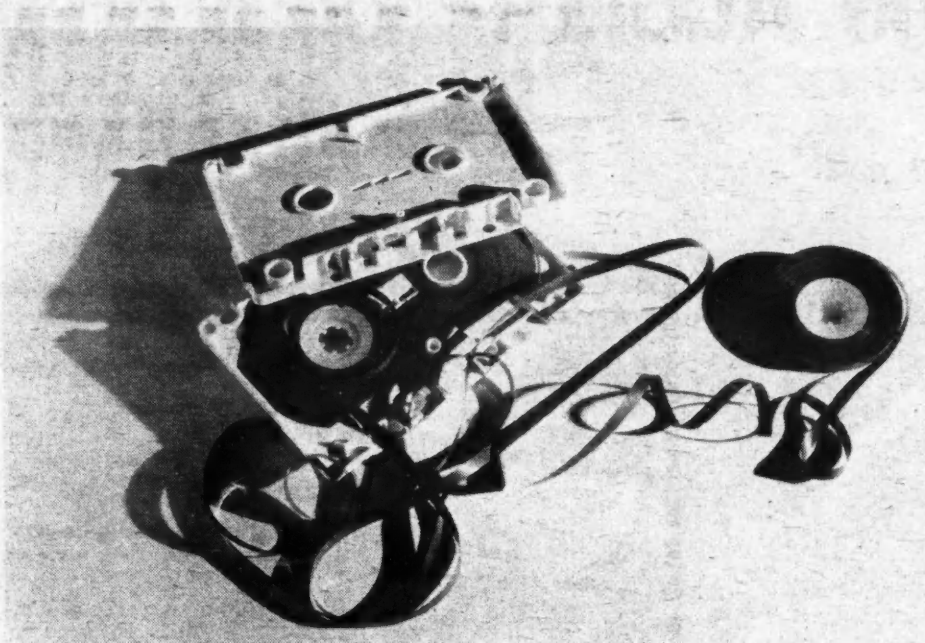

David Krathwohl

THE PLAY BY PLAY

The cassette and the godmothers

by Robert Long

It's been a long way from there to here — from the handy but muffled mono dictation cassettes to the modern hi-fi-stereo glamour-queen cassettes of today with their $1000-plus decks and their Dolby-Bs and all that. The Cinderella cassette needed a lot of fairy godmothers along the way to make it. But somewhere under the glitter of response to 18 kHz and the scent of *eau de chrome*, I seem to smell pumpkin. What time did you say it was?

The original cassette, like the bedraggled Cinderella by the fire, was not without appeal. Convenience isn't to be sneezed at, even in the humble context of workaday recording. So what if the dynamic range and wow-and-flutter and frequency response weren't fit for a prince (charming or otherwise)? Here was a portable reel of tape that ordinary Joes like you and me could slip into a breast pocket and hold close to our hearts. We could get a half-hour or more of recording at a clip without changing the tape, and we wouldn't spill it all over the carpet when we did. Open reels were never like this.

And then the fairy godmothers came along and did a job that would have made Dior blanch. Since none of them had a corner on the magic market, it didn't happen overnight. There were years of hard work in research labs, on production lines and in workshops all over the world. Solid engineering had to take the place of incantation. And it had to extend to every part of the cassette system: the drive motor and capstan, the heads, the meters, the electronics, the controls, the tape (meaning magnetic particles, binders, and backings), the cassette shell — everything.

Everyone who has followed the transformation must be at least passingly familiar with what happened to the magnetic particles. Manufacturing techniques for regular gamma ferric oxide were refined to reduce noise, raise output and increase high-frequency resolution. Every year there were gains — not dramatic ones, but consistent ones. Then someone got the idea of adding cobalt to the ferric-oxide mix. It was a dandy idea on paper because it hyped up the tape's performance; but in the form in which it originally was tried on tape itself, the cobalt didn't work so well because performance was inconsistent, erasure due to mechanical stress was quite audible in the high frequencies, and print-through was high. It took a lot more work before cobalt could be made to do its thing on tape without these disastrous side effects.

But in the meantime the du Pont people had produced pilot samples of chromium dioxide tapes — intended, originally, for the video and instrumentation tape markets — whose potential was seized on as a way of making the cassette "truly hi-fi." It took some doing, but eventually some of the chrome tape was slit down from the more imposing sizes for cassettes.

One thing that made the chromium dioxide so special was that it could be loaded with signal at high frequencies without complaining. It would, in fact, take more highs than most music dishes out. So some bright engineers realized that if you boosted the highs while you were recording on chrome, and then pulled them back down to playback, the hiss would be suppressed more than it would be with the milder boost-and-cut procedure that was being used already for ferric tapes. That's where the "chrome" switch position, which now is included on any cassette deck with even the flimsiest of claims to high fidelity status, originally came from.

Even before *that*, the Dolby B noise-reduction circuit had been introduced to do the same thing: control the hiss that is inherent in all tapes but more evident in garden-variety cassettes than in open-reel tapes. Chrome and Dolby together produced the first cassette tapes that could

Continued on page 47

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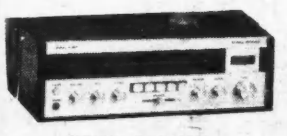
R340B AM/FM Stereo Receiver



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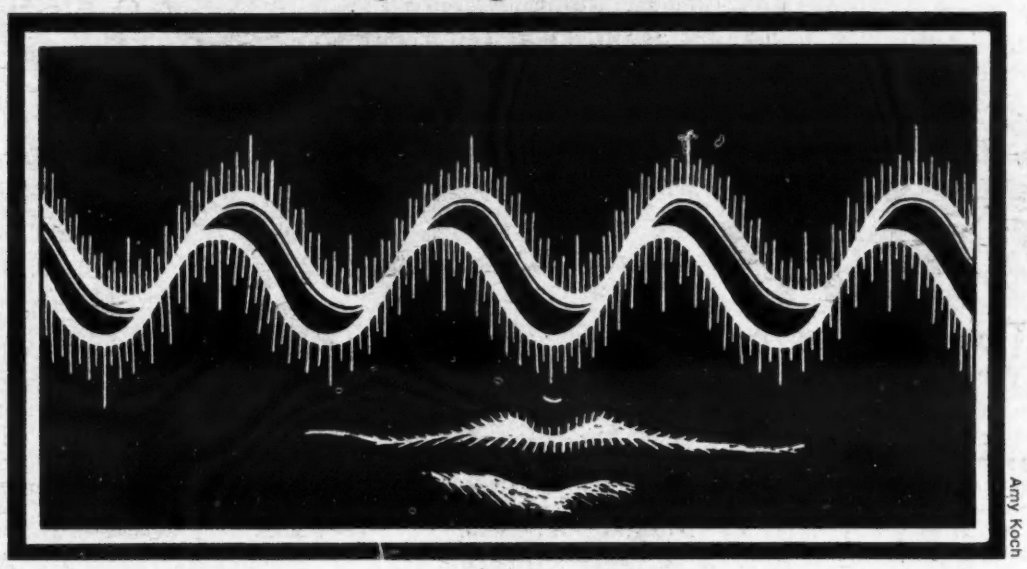
AM-MMMMMMM, FM-MMMMMMM

Humming along with the music



Amy Koch

by Herkimer Bell

With the exception of a very few battery-operated devices, every audio component is AC-powered. Thus every component has in it somewhere a 60 Hz signal of great strength (110 volts). This tone is vastly stronger than the ordinary musical audio signals, which in phono preamps and tape recorders range in strength from about one volt down to less than 0.0001 volt. Although the 60 Hz tone is a hundred to a million times stronger than the musical signals, we demand that not even a trace of the 60 Hz tone should leak into the audio signal, lest we hear it as hum.

Of course, this is a nearly impossible demand — and in fact, most audio components do exhibit readily measurable hum mixed in with the musical audio. Indeed, we would be much more troubled by hum than we are were it not for a lucky factor. Our ears don't have flat frequency response at low loudness levels, so we are much less sensitive to low-level hum than we are to the middle frequencies where most musical energy is concentrated. If our ears had flat frequency response we would find the hum levels in most equipment intolerable.

Even so, it is probably true that most audio systems produce some audible hum when playing records or tapes. One reason why hum is so hard to eliminate has to do with basic physics. Whenever a varying (non-DC) electrical current exists, it radiates — *i.e.*, it acts like a miniature radio transmitter, producing "electromagnetic radiation" (EMR). Radio, television and sunlight are examples of high-intensity EMR. While WBUR-FM radiates ("broadcasts") at a frequency of 90,900,000 Hz, every AC power cord in your home is radiating at a frequency of 60 Hz. A "power transformer" (there is one in every audio component) contains an AC power cord coiled around an iron bar to increase its radiating efficiency.

So two of the commonest causes of hum in an audio system are immediately apparent. First, if an audio signal cable — especially one carrying a weak signal such as the output from a phono cartridge — runs parallel to an AC line cord it will pick up the radiated hum. Second, if a signal cable passes close to a power transformer, it will pick up the strongly radiated 60 Hz hum. The latter is an especially common situation. For example, if your amplifier has its phono input located at the left-rear corner and its power transformer inside at the right-rear, and you choose to place your turntable to the right of your amplifier, then your phono signal cables have to pass through the power transformer's radiated hum field on their way to the phono input jacks. Solution: simply locate the turntable at the left side of the amplifier. Similar cautions apply to tape recorders, not only to their cables but also to the location of the recorder itself. The playback head of a tape deck is a sensitive detector of radiated hum fields, so it should be located well away from the power transformers of other components in your system. How far away? In most cases two feet is adequate.

Just as a wire can radiate, so also any wire is a receiving antenna. Therefore in audio all connections are made via "shielded" cables, the purpose of the shield being to minimize the

Continued on page 46

All Electronic Equipment is checked and a performance certification sheet is provided with each unit. Our standard extended warranty applies to all units.

LUXMAN

All Electronic Equipment is checked and a performance certification sheet is provided with each unit. Our standard extended warranty applies to all units.

In the short time Lux equipment has been available in this country, it has been recognized as one of the finest electronic lines ever offered.

Unfortunately most of the attention has been focused on the pre-and power amplifiers with less given to the three Luxman Integrated amplifers. These amplifiers offer a level of objective performance flexability and musicicality previously unobtainable at these price levels.

L80V
50 watts per channel, minimum
Distortion less than .05%
$475.00

L85V
80 watts per channel, minimum
Distortion less than .05%
$765.00

L100
110 watts per channel, minimum
Distortion less than .05%
$995.00

The above specifications while excellent, do not give a real indication of the superb performance of these "smaller Luxman's". They offer the same level of performance as the separate units at a considerable savings.

harman/kardon

The HarmonKardon 730, rated at 40 watts per channel, is the most powerful in the line of quality receivers from this long established American manufacturer.

The conservatively rated amplifier section typically has less than .1% harmonic distortion. A tuner section comparable to their own Citation series, long regarded as near state of the art and control features notable for flexability logical layout and ease of use.

The 730 is another example of Harmon Kardon's policy of offering the most performance for dollar spent.

If you're considering the purchase of a receiver in the $400 to $600 range, listen to the 730, the definative receiver.

$420.00

Connoisseur

This belt drive, semi automatic turntable has long offered the kind of performance normally associated with units costing over $200.00.

The very low rumble (-60dB) and low mass, low friction tone arm allow the use of high compliance cartridges not normally compatible with units in this price range.

The Connoisseur has been rated a "Best Buy" in the press and we certainly agree.

The BD2A is **$145.00** with base and hinging dustcover.

B&W

The Bowers & Wilkens DM6. Two years of research and a considerable sum of money have created a remarkable loudspeaker. The DM6 is a state-of-the-art loudspeaker of moderate size and efficiency using three wide band drivers in a physical & electrical linear phase configeration. (All designed & manufactured by B&W using new materials & technology). It is the only loudspeaker favorably compared to the legendary Qal ESL. by the British high fidelity press. Unlike other state of the art loudspeakers, there is no need to use high powered & expensive bi-amplified systems. Use with 50 - 100 watt per channel, high detination amplifiers produces high levels & more than adequate dynamic range.

At **$1200** pr. the B&W DM6 will never be a best seller. However, if comparied to other candidates for state of the art the B&W DM 6 is by far the most reasonable choice. The DM6 is the only loudsepaker of its kind & MUST be heard.

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SUFFOLK AUDIO

High performance is the standard

In the development of our $4000 state-of-the-art Servo Statik 1A we came across new principles which we determined to incorporate into less expensive speakers—principles concerning crossovers, and particularly the phase relationships of component drivers in a system. By properly balancing the phase leads and lags of each driver, and by scrupulous design of the drivers themselves, we are able to reproduce recorded temporal information absolutely accurately in a speaker of modest size and price.

Stated simply—there's a depth perception about the Monitor Jr. that is much like being in an acoustically perfect concert hall.

Listen to other speakers—even very expensive ones. In any one microsonic moment, generally the tweeter will speak first; then the midrange; then the woofer.

Listen to the Monitor Jr. It delivers the temporal information precisely *in* phase: first the transient attack, then the first echo, the second echo and the subsequent reverberation. You hear the natural, undistorted depth and ambience of the concert hall!

And note the spatial relationships of the instruments. If the tymps were on a riser to the left rear, they sound that way. If the clarinet soloist was in the second row just to the right of the podium, she sounds that way.

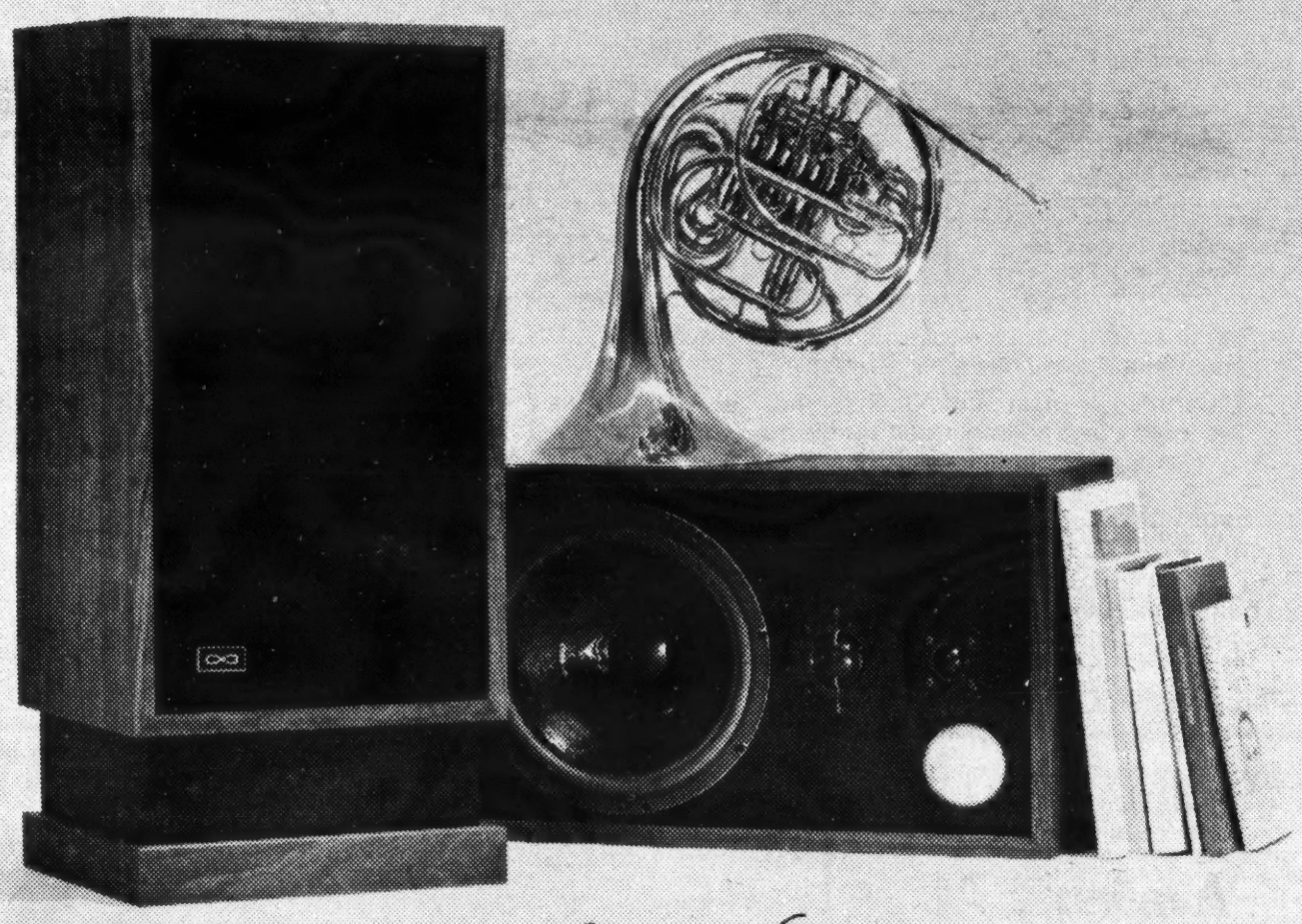
Our crossovers are greatly responsible for this dimensionality. Each of the six drivers of the Monitor Jr. system—our two sets of 12″ transmission line woofers, our 1½″ dome midranges and 1″ dome tweeters—speaks with a temporal integrity and an individual accuracy of depth-information in a way that can only be called startling.

And note the optional $25 set of pedestals. They position the Monitor Jr. off of the floor for optimum reproduction; yet it functions beautifully on the bookshelf.

Our Monitor Jr. brings you the life-like warmth and accuracy of our Monitor II. And its price is roughly half—about $225.

Not a bad investment—to own your own concert hall.

Step into Infinity's little concert hall: The Monitor Jr.



Infinity

We get you back to what it's all about. Music.

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Nikko comes in loud and clear.

"Ever since I brought my Nikko 7075 receiver home, there's never been a quiet moment, at least that's what *they* say. They call it noise, I say it's the closest thing to being *there*. On the other hand, I can have my cake and eat it too, with all the power I want at my fingertips. Nikko didn't spare a thing when they built this AM/FM stereo receiver. It's loaded with all the latest circuitry for top level performance and reliability. My Nikko dealer told me to read the warranty card for full details, and man, was I surprised to find a great three year parts and labor warranty! I'm jazzed. The Nikko 7075 is a solid receiver and a good value. Besides, my chick likes it, too, and that's what really counts."

NIKKO

Nikko Electric Corp. of America
16270 Raymer St., Van Nuys, Calif. 91406
In Canada:
Superior Electronics, Inc., Montreal

Available At:

tech hifi

All Locations

240A Newbury St., 870 Commonwealth Ave., **BOSTON /** 38 Boylston St., 182 Massachusetts Ave., **CAMBRIDGE /** Route 9, **FRAMINGHAM /** Route 1, **DEDHAM /** 835 Southern Artery, **QUINCY /** 352 Main St., **STONEHAM /** 279 Main St., **WORCESTER /** 259 Triangle St., **AMHERST /** 186 Main St., **NORTHAMPTON /** Hanover Plaza, **HANOVER /** 375 North Montello St., (Route 28) **BROCKTON /** Rt. 1 Northbound, Augustine Plaza, **SAUGUS /** Main St., **HANOVER, N.H. /** Nashua Mall Extension, **NASHUA, N.H. / The Service Center:** 870 Commonwealth Ave., **BOSTON / The Bargain Center:** 667 Main St., **WALTHAM /** Stores also in Rhode Island, Connecticut, Vermont, New York, New Jersey, Ohio, Pennsylvania and Michigan.

The Nikko 7075 amplifier section has a minimum continuous power rating of 43 watts per channel, both channels driven, 20-20kHz into 8 ohms, at no more than 0.5% total harmonic distortion. $399.95. This price is shown for informational purposes only; actual retail price will be set by the individual Nikko dealer at his option.

Come hear a demonstration of the awesome Phase Linear 700B stereo power amp this week at The Hifi Show.

We'd like you to think of Tech Hifi as The Hifi Show.

Where you can hear a demonstration of the Phase Linear amps and preamps, or any of our other 100 lines of quality components, any time you'd like.

Tech Hifi is the store where the salespeople know what they're talking about. We sell nothing but hifi (no boob tubes or transistor toy radios), so our salespeople can concentrate completely on keeping up with hifi technology.

The Hifi Show is in town. Tech Hifi.

Phase Linear

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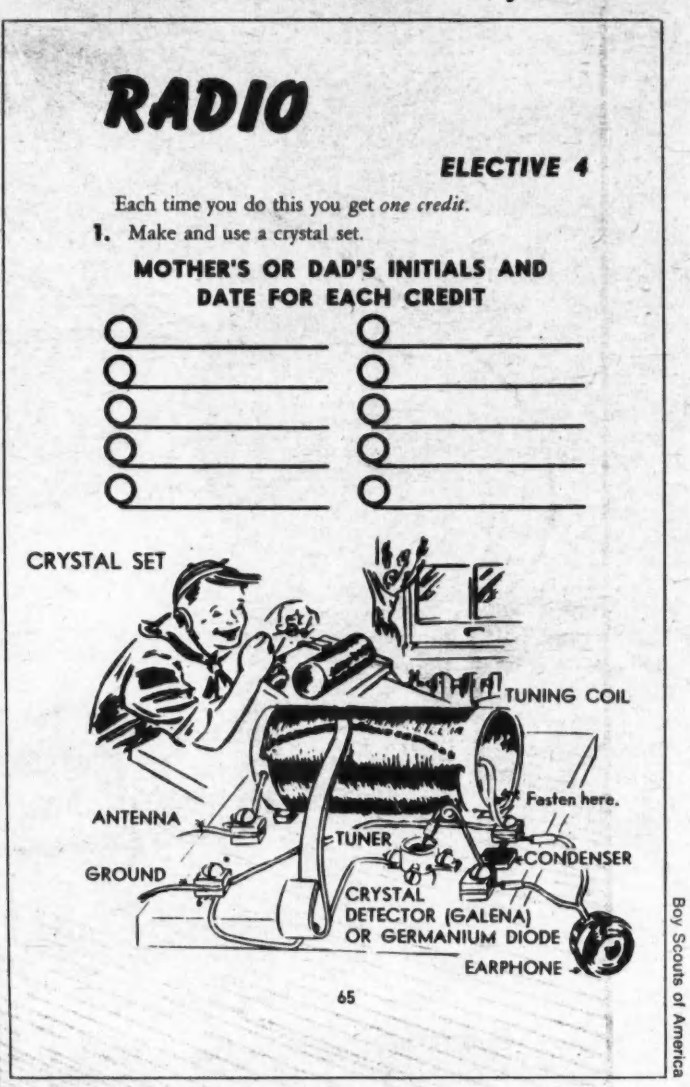
SHORT CIRCUITS

Confessions of a transistor junkie



by Joe Novak

I've learned just enough about electricity to be dangerous to myself, and I blame it all on Flash Gordon. That's right. There was usually enough ozone around Buster Crabbe to neutralize a spray deodorant factory. There were so many generators, Tesla coils and ray guns going at once on that show that the biggest hazard had to be the octopus outlets littering the studio floor.

Oh, but I was a slow learner. At the advanced age of eight, when people like Faraday have already made basic improvements on the rheostat, I was pounding nails into pieces of wood and stringing wire around the nails. I called the results "power plants." You might say I had a bit more imagination than Faraday. My education picked up a bit one afternoon when I fell on a plug, leaving only the two metal prongs in the wall outlet. I tried to pull both of them out with my bare hands. Contemplating from the other side of the room just what exactly had gone wrong, I decided never again to pull both prongs at once. As a matter of fact, except for flashlight batteries and toy motors, I pretty much let electricity alone for a while, and it flourished without me.

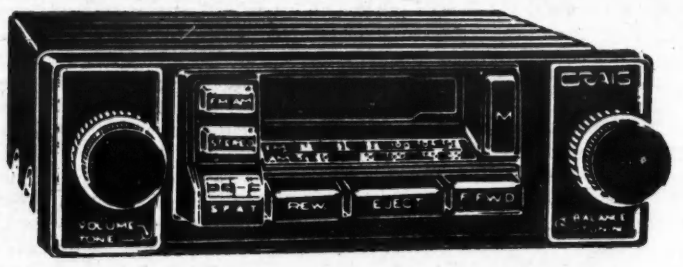
My hitch in the Cub Scouts only set me back further. They encouraged me to make one of those idiot "foxhole radios" that my dad supposedly used to amuse himself in the trenches. I never really believed I could hear radio by tuning a razor blade with a safety pin and pencil lead. My lack of faith was justified. There was to be no Tokyo Rose on *my* Gene Autry wallpaper. The only thing I could do with the rig was write a goodbye note and slash my wrists. Perhaps my insulated thumbtacks had shorted out. I'll never know. I had to settle for a tin can tom tom, and the disgrace was too much to bear. I deserted.

It was clear that what I needed most was a little success. It came when I discovered the General Purpose Germanium Diode for 22¢ in the Lafayette Radio Catalog. Now the diode is to the razor blade what the microchip is to the abacus. Hell, a diode is practically a radio all by itself. Put an earphone across one near any city and you'll hear voices. Run a wire from the diode to the screw on a wall outlet and the voices will be stronger. Add an antenna and a tuning condenser and you'll get more than one station. Add a couple of transistors to amplify the signal and you can replace the earphone with a small speaker. You'll have to bias the transistors with power from a battery, and you'll want a potentiometer (or volume control) as well as an output transformer for the speaker. But this is escalation; one is already flirting with the very real danger of becoming an electronics nut. It's a thin line.

Now at this particular time I still hadn't the slightest idea what high-fidelity music reproduction meant. Neither did most of the rest of the country. Stereo was relatively new, and component music systems were seldom found in people's homes. To our uneducated ears, there was nothing wrong with the little tabletop boxes manufactured by Westinghouse, Motorola and Voice of Music. The strident, shallow tone that emanated from their minuscule speakers was music enough for us. It didn't matter if new records made the cabinet buzz. Those elephantine "tone arms" with their genuine sapphire needles soon removed most of the irreproducible music from the grooves. You remember what it was like:

Continued on page 16

Ray Charles' 44 passenger Viscount has the best sound in car stereo.



There are 16 speakers in Ray's plane. All part of one Craig Powerplay car stereo system.

Powerplay has three times the power of conventional car stereo. And more power means clearer sound with less distortion at all listening levels.

Ray's Powerplay is cassette, but there are 8-track models too.

CRAIG® POWERPLAY™

When you're serious about music.

Available at these fine dealers:

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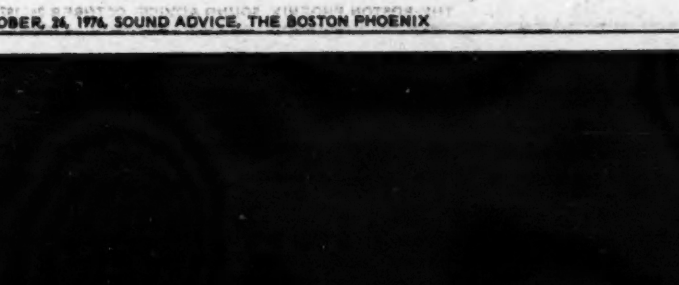
Come hear a demonstration of the 1977 line of Kenwood receivers this week at The Hifi Show.



We'd like you to think of Tech Hifi as The Hifi Show.

Where you can hear a demonstration of the new Kenwood receivers, or any of our other 100 lines of quality components, any time you'd like.

Tech Hifi is the store where the salespeople know what they're talking about. We sell nothing but hifi (no boob tubes or transistor toy radios), so our salespeople can concentrate completely on keeping up with hifi technology.

KENWOOD

Boston, Brockton, Brookline, Cambridge, Dedham, Framingham, Hanover, Northampton, Quincy, Saugus, Stoneham, Waltham and Worcester.

SHORTS

Continued from page 14

your parents thought you were being an insufferable little snot if you asked them to hold records by the edges. And maybe they were right. I guess it depends upon how you asked.

With this kind of background, you can understand why I wasn't too impressed when "Goody," my favorite teacher, invited me to his home to hear his "phonograph." In 1961 Goody was undoubtedly the badass Goldfinger stereo mogul of New Brunswick, N.J. Hi-fi salesmen must have had perspiration explosions just thinking about him. Fat and brilliant, with a weakness for sweet cakes, creamy coffee and high-powered amplifiers, he introduced me to some of the better things of that time: stereo, cherries jubilee and J.D. Salinger. He said he'd built his phonograph himself, from kits. Why would anyone, I wondered, want to build his own Voice of Goody rig?

The thought persisted as we slowly made our way up the dark and creaky staircases to the top of a house Charles Adams would have loved. We came to a door with the spray-painted legend "Powder Room," and we entered. The first thing I saw was the speakers. There were three channels, each composed of an AR-1 woofer topped by a JanZen electrostatic tweeter system containing four high-frequency radiators. Of course, I didn't know at the time what I was looking at.

Goody took me into the adjacent control room. Separate Citation power amplifiers for each channel. A Citation preamp with more knobs and switches than you could possibly adjust during one side of an LP. Ampex tape deck. Rek-O-Kut turntable with separate walnut tone arm of another manufacture. Citation tuner. The output tubes on the power amps were as big as babies' arms. Transformers the size of monkey skulls. He showed me one of his backup cartridges, a model manufactured by ADC. "These cartridges," he announced in a tone appropriate to convey atomic secrets, "are the finest in the world!" So this was what he meant by the innocent term "phonograph"! I realized that I had never heard a phonograph before.

Slowly he brought the beast to life. Beautiful, delicately colored gases glowed from within. It gleamed like the devil from little jeweled indicator lights. And a steady, frightful hiss began to fill the room. The first thing he played was "Wild Cherries," a stereo show-off piece with the clear, bright transients of a phantom xylophone that was here and then there. While I sat there with my jaw hanging open he put on a record he thought I'd appreciate even more — Del Shannon's "Runaway." Imagine, if you will, the reaction of one who had only heard that song through 2½-inch speakers driven by six-transistor circuits powered by dying nine-volt batteries. It was the difference between the Port Authority Bus Terminal and the Palmer House, between Bayonne water and French champagne.

He told me about the incredible one-speaker stereo system his friend was designing. The single speaker moved from channel to channel across the room on a greased rail. The system usually moved too fast to be seen, eliminating troublesome decorating decisions and ventilating the listening room in the bargain. Then, too, a handy means of suicide was always available. One had merely to wander into the speaker system to be neatly severed without a note being missed.

Inspired by all I had seen and heard, I headed to my local electronics store and obtained my very own catalog and all the basic tools: a screwdriver, a soldering iron, a wire stripper and pliers. I was going to resume the manufacture of ridiculous devices I had forsaken since my ill-fated Cub Scout days. Oh, but I loved that catalog! You could buy bags of colorful little striped carbon resistors that looked like cockroaches wearing rugby shirts, and a wonderful pocket decoder to find out what the colors meant. They sold flea clips, alligator clips and banana plugs by the bunch. Bags of 1001 Arabian diodes for $1.89. They tempted you with cheery cherry-colored panel lights, delicious electrolytic capacitors with liquid centers, chassis punches, cardioid mikes, flat-headed screws and assorted nuts, vibro tools and insulated strippers. They made you yearn for socket wrenches and private earphones (flesh colored), every type of switch imaginable, whip antennas, cattle prods, RCA jacks and stranded hook-up wire. Everything an All-American Weirdo could want.

I was particularly fond of knife switches and 90-volt batteries. You know how it is when you're a frustrated kid. With one of these 90-volt nasties and a few other parts I built a one-tube regenerative (or was it degenerative?) receiver that actually worked. It was tuned by adjusting a ferrite core coil antenna with a screwdriver, if you knew what was good for you. The interesting thing about this radio was that it caused loud, high-pitched squeals to come out of any nearby commercial table radio tuned to the same station. I only found this out by accident, because my parents were in the other room listening to the radio. They couldn't figure out what was wrong, so they changed the station. A twirl of my screwdriver soon had their radio squealing again. Again they changed the station, and after a brief wait to make them think everything was finally all right, I resumed my nasty play. You can imagine how happy they were when I told them at last that there was nothing wrong with their radio.

But I can't go any further without confessing to you that I wasn't cut out for all of this. Half of the idiot-simple radios and amplifiers I tried to build didn't work. I never bought a 1000 ohms/volt pocket multimeter for five bucks from Radio Shack to find out what was wrong. If I had a burned-out FET, I didn't know. If the number two .005 mfd. condenser was kaput, I acted as though it were my fate. I never clipped the coupon in *Action Comics* for the home study course with my own oscilloscope and signal injector to keep. And that's why I'm a bum today.

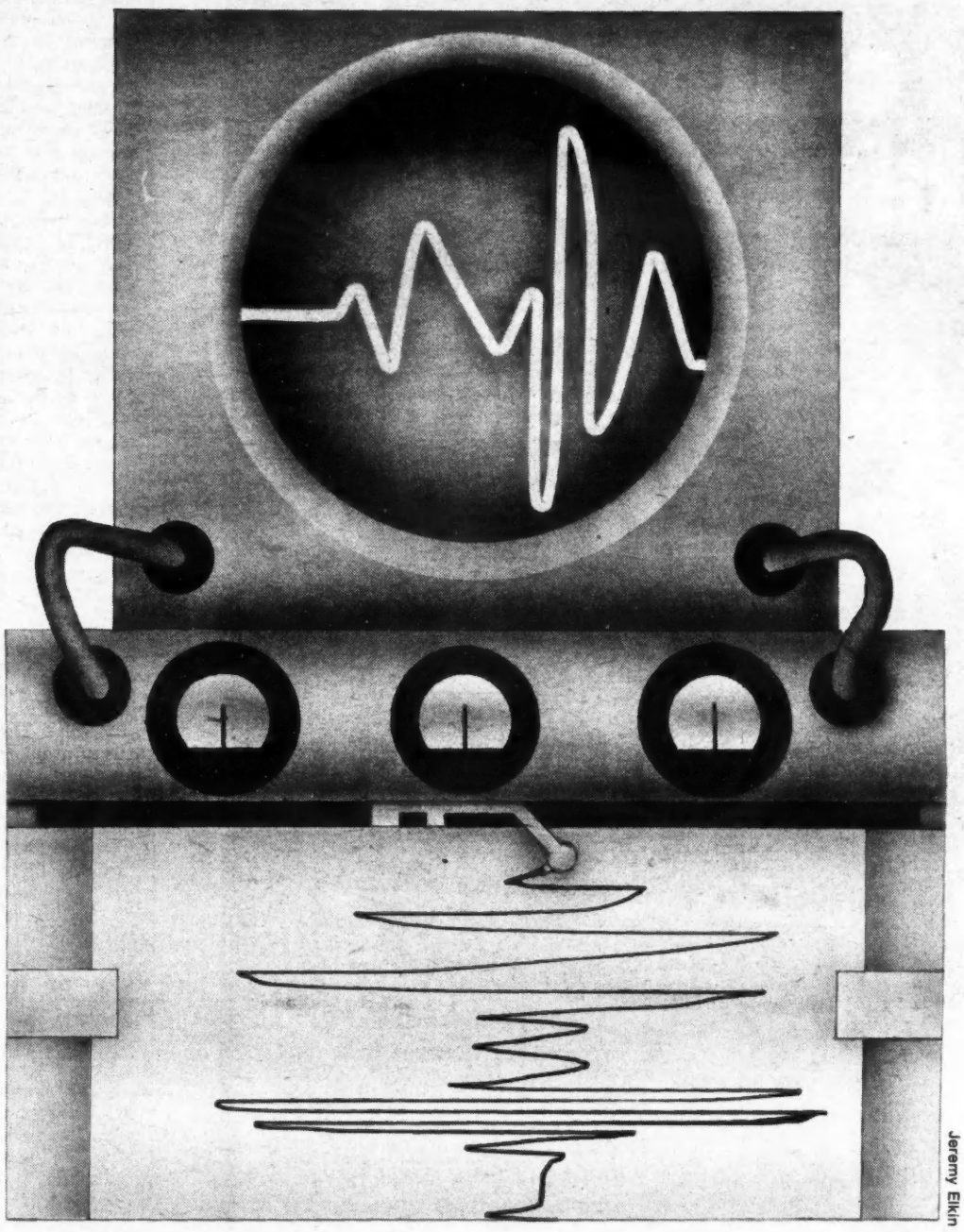
There was, however, one moment of glory — a last hurrah. I invented the Walrus, a self-propelled stroboscopic light and AM radio designed as a crowd control vehicle for the coming police state. I constructed a model of the actual vehicle, which would stand 15 feet high and broadcast baseball games and Avi Nelson at high volume through a specially designed high-distortion loudspeaker while flashing an intense blue stroboscopic light. A frightening electronic sound will be available, along with the natural rumble produced by the powerful engine and massive wheels. A large sign at the top of the vehicle will say "THE STATE IS LOVE." A smaller sign on the front will proclaim "I am the Walrus."

The day came at last when my friend Wendy and I decided to build ourselves a stereo from kits. With my years of experience, I was smart enough to let her assemble the relatively complicated preamplifier, while I wired the simple power amp. It was a good move. When all was hooked up and turned on, it burst into song. Good ol' Wendy.

DRAWING YOUR OWN CONCLUSIONS

It Hertz to be in love

by Tomlinson Holman



Jeremy Elkin

Where technology is employed to reproduce art, special language and methods must be employed in order to ensure the integrity of the result. Engineering necessarily makes tradeoffs between one aspect of technical performance and another, according to certain criteria. In the audio field, these criteria are derived from listening tests. Because our ears are not calibrated test instruments, the results of subjective listening tests are excruciatingly difficult to translate into engineering language. While the largest corporations such as Eastman Kodak and Bell Telephone are slowly extending the new science of psychometrics to the study of human perception, there is no such rigorous body of knowledge for the hi-fi industry to draw upon. Consequently, performance criteria are developing much more slowly than the hardware itself. The result is that most hi-fi products are designed without much consideration of subjective effects, their performance being instead determined by whim or, more often, by marketing strategies — the "numbers game."

In high fidelity today, many numbers games prevail: higher and higher input overload numbers, higher and higher slew rates, higher and higher power. Which of these are "real" and how much of a given property is necessary — or sufficient — are becoming increasingly important questions.

One important area of performance that should not be overlooked is the interactions among components within a stereo system. A recent survey looked at one source of these interactions — the effect of phonograph preamplifier inputs on cartridges. Of nearly 30 units tested, only half of those units *failed* to interact with the cartridge to produce audible error. Another important interface is between amplifier and speakers. Some amplifiers can deliver but a fraction of their rated power into loudspeakers without considerable distortion. The test-bench environment, with its "perfect" load, just does not allow us to see the effects of real ones like speakers. Interaction is a principal source of frustration to those who read the audio cultist magazines — an author may recommend a system that sounds good *when all of its component parts are present* (includng the listening room). But to draw conclusions about an individual piece of equipment from such a test is difficult.

(Installation can easily overwhelm the differences among components. Some people proudly tell of their such-and-such expensive tuner which is receiving stations from over 100 miles away with just a piece of wire on the back. What they don't realize is that much, much cheaper tuners will out-perform their unit if the cheaper is connected to a proper roof-top antenna ($30). Worse, and more common, is the system whose speakers are connected out of phase, resulting in very poor bass response and stereo imaging.)

Many important areas of performance are frequently overlooked — or adequate, comparative specifications are unavailable. One way to compare two units is to look at the same magazine's review of each unit. Even if the lab does not use tests that most accurately indicate the audible differences among components, the test results are comparable because the techniques are usually identical. But don't fall into the trap of misinterpreting numbers: no sophisticated listener will tell you that there's any audible difference between 0.1 and 0.05 percent THD (total harmonic distortion), for example.

Turntables and cartridges

There are only two specifications that really tell you much about the quality of a turntable. They are rumble, and wow and flutter. Unfortunately, specifications from one manufacturer may not correspond to another's because of differences in measurement methods. (Off-center records, which mask the differences in wow among turntables, are all too common.) The best guide here is test reports on various turntables coming from one source. CBS Labs, which provides data for *High Fidelity* magazine's test reports, has done testing on the audible effects of rumble and has come up with an ARLL weighting curve, which is an attempt to make a measurement that corresponds to the audible effects of rumble. Flutter is more comparable from manufacturer to manufacturer and magazine to magazine.

Cartridges are pretty well-characterized by frequency response into a specified load, maximum tracking capability *vs.* frequency, tracking force range, distortion, etc. A common misconception about cartridges is that those which track more lightly are necessarily wearing records less. While it is true that a cartridge which tracks well at five grams causes more wear than one that tracks well at one gram, it is a mistake to believe that if the manufacturer has specified a range of one to two grams, tracking at one gram will produce less wear. In fact, if at one gram the cartridge consistently mistracks, the stylus does not maintain good contact with the groove wall and bounces along gouging up the record. A good rule of thumb is to use a tracking force towards the top end of the manufacturer's rated tracking force range (and to own a cartridge whose top required force is two to two-and-a-half grams).

So what about the differences that people hear among cartridges? Some audiophiles tell you that such-and-such a cartridge has more "air around the sound." This effect is *due to a defect* in the alignment of the tiny pole pieces and coils to the groove walls, resulting in the production of more difference information (L-R) than sum in-

Continued on page 18

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HERTZ

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formation (L&R) and thus a more ostensibly spacious sound without good focus on center images. Such an effect must be considered a defect since it introduces a quality not meant to be heard from the record. It is possible to inject this out-of-phase spaciousness electronically, but, provided wih a control, most people prefer its normal rather than its exaggerated stereo setting.

The big practical problem in the turntable-cartridge system is the interaction between the two — something which manufacturers of turntables and cartridges do not like to admit. I'll discuss presently how particular combinations of arms and cartridges can generate problematic signals which must be handled by the system. But another problem is this: installation errors of as little as 1/16" in the position of the cartridge can double distortion. Be certain that you follow the instructions with the turntable for installation of the cartridge, making sure that the overhang is adjusted properly, that the top mounting surface of the cartridge is parallel to the record surface, and, in looking at the cartridge head-on, that the stylus seems perpendicular to the record. (You can check this with a small mirror laid on the turntable platter; the reflection should line up with the stylus above it.) Spending a few careful minutes here could easily quarter the distortion of your system.

Phonograph preamplifiers

In the phonograph preamplifier section (of a preamplifier, integrated amplifier, or receiver), the minute output from a phonograph cartridge is amplified to match the level of other, higher program sources. Disc recordings are pre-emphasized (following to RIAA curve) for noise reduction. The preamplifier follows a specific frequency response, inverse to that used in recording, to restore flatness. "RIAA error" measures the extent to which this response is not matched. However, many systems' cartridge and preamplifier interact improperly. This interaction takes the form of frequency response aberrations. Since the cartridge is essentially a coil of wire wound around a core, its impedance rises dramatically with increasing frequency. Thus a cartridge is really rather sensitive to preamplifier loading at the highest frequencies. In listening tests, this error shows up as an idiosyncracy of a phonograph preamplifier, generally undetected in conventional frequency response tests with an audio generator, but one which makes different preamplifiers sound different to observers. And, interestingly, most observers do *not* describe these differences as being frequency response-related but as "muddy," "clean," "transparent," or "airy."

"Phono input overload" is the amount of voltage (off the record and through the cartridge) that the input circuit can amplify before distorting; since there is no volume control to regulate the level arriving at the input, overload cannot be avoided by turning something down. The measurement is made at 1 kHz, but the input overload number actually varies across the spectrum in most preamplifiers because of RIAA equalization. Here is an example of how manufacturers play the numbers game with the ante set at 500 mVrms. But how much is really necessary? It turns out that the single highest peak ever found recorded in a huge survey of records, and hypothetically reproduced by a high output cartridge (even though the cartridge cannot track the peak — we're speaking theoretically), produces about 95 mVrms at 1 kHz. In order to obtain a higher overload specification, an amplifier manufacturer may sacrifice gain, and you may find yourself unable to tape the output, or to get sufficient level from a low-output record, to load your system. This is one of the easiest specs in the world to get — simply reducing the internal gain below normal, or increasing the voltage supplied to the preamplifier, will take care of it. And as far as everyday peaks go: a couple of recent afternoons' work with everyone's favorite "hot" records showed that peaks beyond 10 times the standard 0 VU were rare indeed. (This corresponds to about 35 mVrms input overload.)

Some audiophiles claim that the elusive differences among preamplifiers lie in the *slew rate*, the ability of the unit's output to keep up with its input and quickly follow every nuance of the input signal. Measurements of slew rates of program material found on records were compared to the rates which one could theoretically cut on records. In fact, the manufacturer of the best available cutterhead was asked this question: if you cut at half-speed (thus doubling the velocity recorded), poured liquid nitrogen in the cutterhead to keep it from burning out, and put in only one tone burst for just long enough to be detected as a tone rather than as a click by the ear, what is the highest velocity you can cut? (Answer: 6×10^6 mu/cm/s.) We combined this number with the sensitivity of the most sensitive cartridge (no existing cartridge, however, could come close to tracking such a level today) and came up with a number that gave us the highest slew rate requirement that could ever be presented to a preamplifier. It was surprising how small the number was: 0.026 volt per microsecond. Our measurements from the most transient-filled records were about one-half of this theoretical value. And this makes physical sense: after all, what we are trying to do is to get an electrical circuit to follow accurately a mechanical one. Since the mechanical circuit is subject to definite limits owing to acceleration (the G forces are phenomenal), it is not surprising that the preamp can be made to follow its input with ease, electrical circuits being usually much faster than mechanical ones.

"Noise" in phonograph preamplifiers is a difficult specification to compare since hardly anyone uses the same standards. The usual test is clearly wrong; it is made with a shorted input, which does not at all approximate a cartridge. A meaningful measurement may be made only by connecting a cartridge and weighting the results. Weighting is the process of compensating for the characteristics of human hearing — your ear doesn't hear low and high frequencies as well as it does midrange volume levels. Doing these tests shows that the theoretically achievable minimum noise is closely approximated by many good designs and that units which are quiet enough can be made with tubes, bipolar transistors, or field effect transistors. The typical measurement for a good unit is about 82 dB "A" weighted below a 10 mV input reference with a typical cartridge. Beware of preamplifiers claiming much better numbers, *e.g.*, 95 dB below 10 mV weighted. This is a sure sign that the design has been optimized for the test bench only — such preamps give worse results with a cartridge connected.

Another problem is also a "systems" one, but the responsibility for its solution lies with the phonograph preamplifier

Continued on page 20

Eardrum wants to be your turntable headquarters!

With the great multitude of hifi stores screaming lowest this, greatest that, and longest the other, it becomes obvious that there are more similarities than differences between them. At Eardrum the approach is quite straight-forward, they want you to make them headquarters for ALL your hifi needs. At Eardrum they bend over backwards to make shopping for your hifi an informative and pleasant experience.

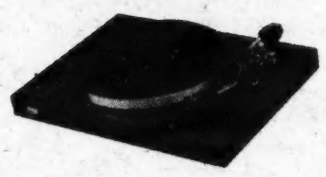
There are two Eardrum stores. One is in Harvard Square, the other in Burlington. Both are well stocked with a wide selection of the latest in audio as well as friendly, knowledgeable professionals who take an active interest in the audio industry. (Read their column "Inside Audio" in the Boston Phoenix).

So if you are looking for a turntable go to Eardrum. They will provide you with the selection and information you need to make an intelligent choice in purchasing the turntable that's right for you.

All turntables include walnut base and dust cover. ● indicates inclusion of cartridge.

Sansui SR-222

The SR 222 is a belt-drive manual turntable. Some notable features are: tripod motor mount to cut noise and assure accurate speeds, S-shaped tonearm with acoustic damping.



$79

Fisher MT-6010

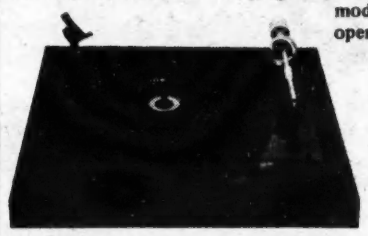
The Fisher MT 6010 is a belt-drive turntable with auto return. Some noteable features are: low mass S-shaped tone arm, heavy cast aluminum platter, viscous damped cueing and pause control.

$99●

FISHER

BIC 920

The BIC 920 is a belt-drive, automatic turntable. Some noteable features: low speed 24 pole synchronous motor, low-mass tone arm, program panel for three modes of operation.



$79

BIC

Philips GA-212

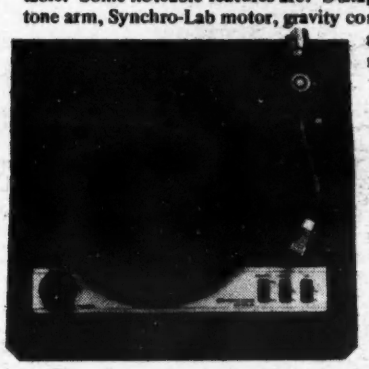
The Philips GA 212 is a manual, servo controlled, electronic turntable. Some noteable features are: low mass, low friction tone arm, all electronic switches, tacho control for precise speed.

$169●

PHILIPS

Garrard 990B

The Garrard 990B is a belt-drive multiple play turntable. Some noteable features are: S-shaped low mass tone arm, Synchro-Lab motor, gravity controlled anti-skate mechanism.



$139

Garrard

Connoisseur BD/2A

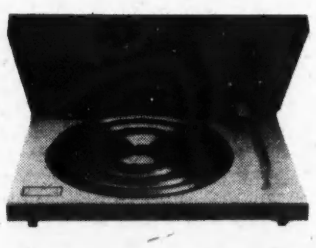
The Connoisseur DB/2A is a belt-drive manual turntable with auto lift. Some noteable features are: Dual voltage operation, low mass, low friction tone arm, non-mechanical lift is solenoid actuated.

$145

Connoisseur

B&O 1900

The B&O 1900 a fully automatic single play belt-drive turntable. Some noteable features: low mass magnesium alloy tone arm, integrated cartridge, single master control for all operations.



$325●

B&O

ADC Accutrac 4000

The Accutrac 4000 is a computerized, automatic, single play turntable with direct drive. Some noteable features are: ability to program selections in random order, wireless remote control of operation, modified ADC XLM cartridge.

$499.95●

Fons CQ30

The Fons CQ 30 is a belt-drive manual turntable. Some noteable features are: SME 3009 tone arm, electronic control, continuously variable speed, Hyper-concentric main bearings.

$399

Fons

Exclusive Phoenix cartridge offer!

Grado F+2 $29	Audio Technica AT11E $20
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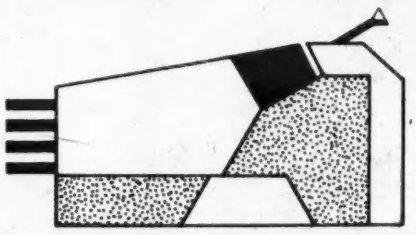

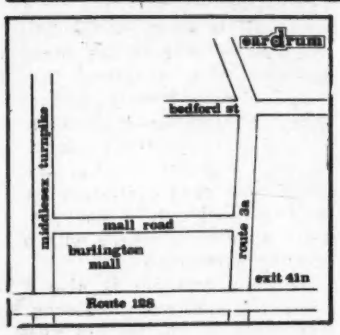

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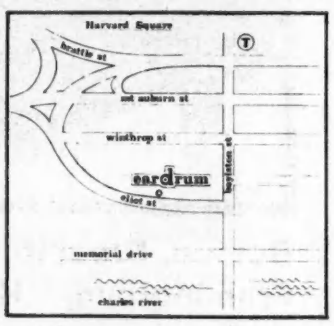

Burlington rt 3a (by valuehouse) 273-1105 Harvard Sq 16 eliot st 864-1155

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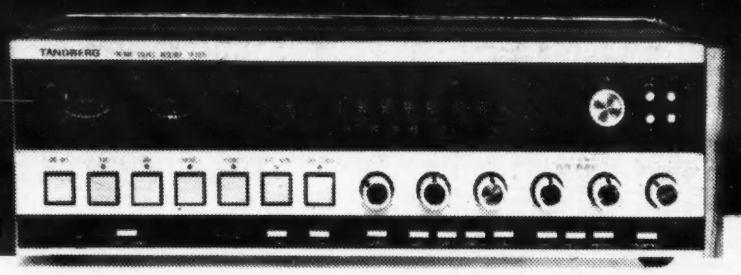

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HERTZ

Continued from page 18

manufacturer. Today, the prevalent practice is to use a highly compliant, low-tip-mass cartridge for good tracking of musical information. When such cartridges are installed in conventional arms, the combination of tone arm/cartridge mass and cartridge compliance resonates at around 4 to 8 Hz. Unfortunately, it happens that this frequency range is excited by record warps. The frequency response peaks just where there are important disturbances from the record, with the result that power is used up in reproducing this garbage, woofer cones flap unnecessarily in the breeze (particularly with vented box loudspeakers, which are unloaded in this frequency range), and stereo imaging is affected. The presence of a good subsonic filter, which steeply attenuates nonmusical signals without having audible consequences (due to poor frequency and/or phase response) will cure this ill. It also helps, with these new high-compliance cartridges, to have a tone arm of as little mass as possible, and to damp the one you do have in the way described in the last (March) Hi-Fi supplement.

So what *are* important characteristics for a phonograph preamplifier? Response flatness with and without a cartridge connected (adherence to the standard curve for a test generator source and non-interaction with the cartridge impedance); the presence of a subsonic filter to eliminate problems with warped records; reasonably low distortion; noise of around 82 dB below 10 mVrms (typical cartridge connected, A-weighted); more than 95 mV input overload; and a slew rate faster than 0.026 volt/microsecond.

What do you do if you have a preamplifier section which you believe may badly interact with a cartridge source impedance? The easiest course is to choose a fairly low-inductance cartridge, which is not too susceptible to loading. Or if you have a technical bent, you can build a simple buffer circuit, which properly terminates the cartridge and feeds your preamp at low impedance for no interaction.

Tuners

Since the specifications for tuners are quite complex, uniform standards for their characterization have been adopted. Unfortunately, even these relatively sophisticated standards do not fully represent real-world cases. Unfortunately, too, marketing departments have long sought better and better numbers on the one test that has come to represent tuner performance in the consumer's mind — usable sensitivity. Boiling down tuner performance to this one number is oversimplification; worse, it leads to the designing of tuners which overload easily. Recently, off-the-air tests were made of four well-respected, current-generation tuners. A rooftop antenna was fed to each of the tuners in turn and the number of times that the strongest station appeared on the dial was counted. Multiple appearances of a station on the dial are the consequences of front end overload — stations intermodulate with one another and produce spurious responses or images. (Otherwise fine tuners got up to 16 spurious responses.)

The IHF sensitivity number has been overused. The number is derived at a level equivalent to a 30 dB information-to-garbage ratio, hardly pleasant to listen to. A more important number is the *50 dB Mono Quieting*. This is the number of microvolts required for a 50 dB signal to noise ratio, which is a decent signal. The *50 dB Stereo Quieting* relates the same operating condition for stereo.

Specifications of tuners made in Europe, or of those for cars, frequently give the wrong impression of sensitivity since the impedance of European or car antenna systems is frequently different from the standard. These difficulties have been resolved recently with the introduction of the dBf scale for input sensitivity, which is independent of impedance and has been scaled by the dB function so that real differences are more apparent — hopefully, no more shall the salesman try to talk you into appreciating 2.0 less than 1.8 microvolts.

The IHF tests used to sample front end overload performance are inadequate to predict what happens in practice; numbers for image rejection and spurious response rejection could not be correlated to performance on the off-the-air overload test. The difficulty appears to be that the test signals used by engineers are neither strong nor complex enough to simulate all of the actual modes of spurious generation. There is an interesting reason for the poor overload performance in many units today. Traditionally, most tuner manufacturers have abrogated the responsibility for the *front end*, that part of the tuner which amplifies, tunes, and converts the 100 mHz signals to an intermediate frequency where most of the amplification takes place, and have gone to outside sources who have the necessary equipment and expertise to produce "front ends." Unfortunately, one figure of merit for these front ends grew up: gain. This allowed the tuner manufacturer more simplicity in his own circuits and thereby kept the cost low. The real cost was borne by the consumer, who now had a unit that would meet all of its specs but that would overload easily. Although the introduction of new technology (like the dual-gate MOSFET) has somewhat ameliorated the problem, it is by no means solved. And still today, those companies respond to questions by staring blankly and asking: "What you mean, not IHF?" They seem to live in a countryside setting where these problems like strong signal overload do not occur.

A practical problem arises in evaluating tuners in the environment of hi-fi stores. With many tuners operating within a few feet of one another, blank, quiet spots appear on their dials. This is the result of each tuner's talking to the other; such proximity does not create the best of all possible worlds for evaluating weak-station performance. Also, hi-fi shops all too frequently have no real antenna system which can simulate what you may be able to do at home.

What to look for in tuners, then? Good 50 dB mono and stereo quieting points combined with good overload performance. How to evaluate overload performance? If the store has a decent antenna system which feeds all tuners equally, you could count the number of occurrences of the strongest station on the dial. Fewer, of course, is better. Finally, the maintenance of low distortion numbers (these you can read about) out to 10 kHz will minimize the potential for developing "birdies," or high frequency garbage, accompanying the music, particularly on stations like WCRB, which seems to undermodulate its main channel signal in favor of its money-making SCA subsidiary.

Tape decks

Tape decks lack standardization of specifications on such basic properties as wow and flutter and signal-to-noise ratio. Wow and flutter in Europe is usually measured to the standards put forth by DIN, the German standards organization, and adopted

Continued on page 22

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Hy Gain
Janszen
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Sansui 331

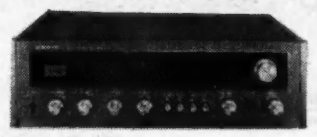
12 watts RMS per channel, (measured at 8 ohms, 40-20,000 Hz below 1.0% distortion)

$139.00

ONKYO TX-330

$189.00

17 watts RMS per channel (measured at 8 ohms, 20-20,000 Hz below 0.5% distortion)



SONY STR-7045

30 watts RMS per channel, (measured at 8 ohms, 20-20,000 Hz below 0.2% distortion)

$259.00

SONY SUPERSCOPE

TC-153SD
Professional Quality Stereo Portable Cassette

$289.00

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Ampex 364 C-90 2 pack 20-20	4.29
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BASF C-90 Studio 2 pack	4.00
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BASF C-120 LHS 2 pack	5.00
SAI C-90	50c
SAI C-90	75c
Scotch C-90 Classic	2.50
Scotch C-60 Classic	1.75
Scotch C-90 Chrome	2.00
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JVC 4DD5	50.00
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Watts Stylus Cleaner	1.00
Watts Manual Parastat	15.00

HERTZ

Continued from page 20

by the American IEEE; decks from Japan are measured to JIS (for Japanese Industrial Standard); and decks made in the US are usually measured by the NAB standard, apparently the same as JIS. But perceptual testers have agreed that the DIN/IEEE standard is the one that equates measured performance with listening. The numbers derived from the DIN/IEEE standard are much worse than those from the JIS/NAB standard (frequently doubled!) and so it is difficult to get manufacturers to use the more technically correct standard. We seem to be having the same difficulty as with power standards a few years back; this is case of consumer misinformation which, if it continues unabated, can be expected to trigger action from the FTC.

As in phonograph preamplifiers, noise measurements of tape decks are frequently done to different standards. Some of the things to watch out for: the reference level used (was it "0" VU or was it some distortion point above zero, like three percent distortion?); was any weighting for human perception involved (and there are at least three different schemes)?; and what were the operating conditions of the recorder (usually a record-playback cycle with no input signal, but not always)? I recently made a chart of the various modes and various standards for one tape deck and found that I could legitimately assign 16 different numbers for signal-to-noise ratio. And, once again, since the combination of standards which claims to be best correlated to noise perceived by the listener is not the one that gives the most impressive looking numbers, it is difficult to get manufacturers to agree on a standard.

Another area that marketing departments like to overemphasize is the top end frequency response limit; they read substantial differences into 15 *vs.* 18 kHz for example, as a high frequency limit. Since this difference is 3000 Hz, it may seem substantial. However, the ear refuses to hear frequencies linearly, being a logarithmically responsive mechanism which sees the difference between 15 and 18 kHz as about one-third of an octave out of 10 octaves, or about one-thirtieth of the spectrum. And since the concentration of program material information rolls off substantially towards the higher frequencies, this difference becomes even less important. But why not have it, you ask? Well, like most things in engineering, the high frequency limit of a tape recorder interacts with other areas of performance. In order to resolve higher and higher frequencies required by marketing departments, narrower and narrower head gaps must be employed to resolve the very short wavelengths, with the consequence that less magnetic flux from the tape reaches the head core on playback. The result is a lower playback voltage from the head for a given recording, and consequently more noise.

Amplifier sections

Here there are a couple of favorite tricks of the trade which aren't totally apparent to listeners. The first of these was prevalent a few years ago and has somewhat abated; the second is the exact opposite of the first and represents a major marketing thrust today. The first is to make the volume control come on fast. Since the consumer makes the assumption that he is only using one-quarter of the available power with a one-quarter rotation of the volume control, such units seem very powerful. All the action may take place in the first one-half rotation, yet he is tricked into believing that he is only using a fraction of the power available from his unit. In fact, the setting of the volume control has only an indirect relationship to the power output. The power depends upon the output of the program source, the setting of the volume control, the impedance of the speaker, and the gain of various parts of the system. Thus it becomes simple for the design engineer to give the impression of the unit's having lots of power by altering the volume control.

A newer trend, the second, has been toward "low distortion" units. The pitch is that they may not provide as many watts per dollar, but they have lower distortion than competing units. And in fact, on the basis of specifications, they do. They provide less distortion at less power than the units with which they compete — but *so do those units.* The clincher is that the dealer can demonstrate less distortion and noise in the unit. How is this possible? By having inadequate gain to drive the output stage into distortion with typical program material and by making the volume control come on slowly. "See, I can turn it all the way up without distortion."

Neither approach is particularly useful to the consumer, except to get him or her to take a receiver or integrated amp home. The first suffers from a lack of adequacy of resolution if one sets the volume control at low listening levels, and also has the probability of destroying the speaker systems' tweeters if anything approaching full gain is used. The second does not allow maximum use of the power capability of the system. A reasonable balance must be struck between these two approaches — the system should have adequate gain to be able to clip (distort) on program material so that full use can be made of the power output capabilities, yet the control should not come on so fast that low-level resolution is impaired. A useful guideline is to have the system play at your normal listening level between the 11 and 1 o'clock settings of the volume control, using your choice of cartridge and speakers.

The FTC has acted to require that the most prominent power rating used by manufacturers be the one that they prescribe. The FTC test is for continuous average power over a specified bandwidth within a specified distortion limit after a stringent preheating. But there was no statement by the FTC that this resulted in a number corresponding to how loud an amplifier would play on program material. In fact, two amplifiers with identical ratings on the FTC test may play at quite different listening levels. Take one amplifier rated at, say, 20 watts continuous that can play at 22 watts for a momentary peak, and compare it to one that plays at 20 watts continuous but can handle 33 watts for a peak. There is no doubt that the unit with the higher peak capability will play louder than the lower unit — yet the ratings are required to be identical by the FTC. Under the previous IHF music power rating (which had its own drawbacks) these differences would have been apparent — and both amplifiers would have been rated at higher output a few years ago. Should you trade in a unit rated at 20 watts "music power" when purchased new a few years ago for one rated 20 watts today? Basically, you can't tell whether the new unit will play louder.

Further, most people do not understand that the ear responds to any difference between levels in a logarithmic way: that is, the difference between a 15 watt/channel unit and a 20 watt/channel one is likely undetectable. *High Fidelity* magazine has started to use a scale of dbW, or decibel-watts, that is a more useful rating for determining how loud an amplifier will play.

Loudspeakers

Loudspeaker assessment is perhaps the most difficult area in which to obtain correlations between objective measurements and subjective judgments. Good loudspeaker designs cannot be evaluated in a vacuum; program material and room placement interactions demand that speakers be designed with them in mind. Fortunately, the general buying public has not been "taken in" by specifications of loudspeakers. People generally believe their ears and buy loudspeakers on subjective judgments, which is all well and good provided one remembers that brighter and/or boomier almost always sounds better — at first. What sounds smoothest longest is usually most accurate.

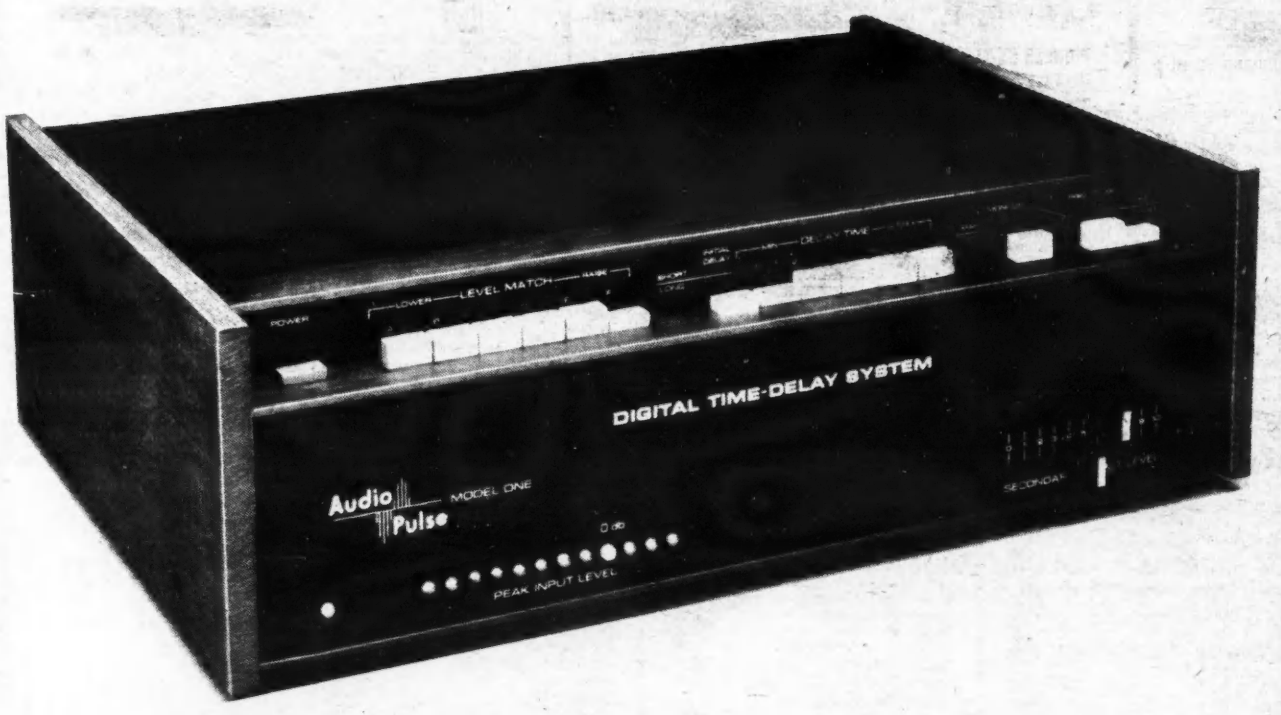
* * *

We've seen that in many areas of specifications, numbers from various sources may not be directly comparable. One solution is to find a source that makes the same measurements on competing units the same way, although even this solution may mislead if the testing organization is not using the standards that most correlate to the human perception of the effect under study.

The future will almost certainly bring more activity in this field; the industry will have to agree to standard specifications, or it will not be long before the government acts to assure the protection of the hi-fi consumer.

REVIEWERS PROCLAIM:

Digital Time Delay Is The Major Breakthrough Of This Decade In Sound Reproduction



A live concert, whether by John Denver or the Boston Symphony, is a much more involving experience than listening to a stereo system. One reason is that at a live concert you are actually enveloped in the ambient sound field of the concert hall. As Technical Editor Larry Klein said in the May 1976 *Stereo Review:*

With few exceptions, even our very best records and tapes provide a simulation of reality that is on the level of, say, a beautifully photographed country scene. The color may be exact, the visual details precise, and the enlargement may be life size, but when you view the photo you know you are looking at a picture, not through a window. What's missing? The crucial third dimension: depth or space. It is the failure to record and then realistically reproduce the ambiance, the acoustic spatial environment of the performance, that is the true weak link.

The Audio/Pulse Model One Digital Time-Delay System is an acoustic space expander. It electronically duplicates the way in which delayed, reflected, ambient sounds produce the richness and depth of a live listening experience. The delayed signals it creates are fed to a second amplifier and heard over a second set of speakers placed to the sides or rear of your listening area. Here's what the hi-fi reviewers are saying:

Julian Martin (*Hi-Fi Stereo Buyer's Guide, Nov.-Dec. 1976*): *The Audio/Pulse Model One Digital Time-Delay System probably ranks next to stereo and stereo FM as the high fidelity highlight of the past twenty-five years, for it really can recreate the sound — and more important the* feeling *— of a music hall.*

Len Feldman (*Consumer Electronics, Feb. 1976*): *Unlike any quadraphonic system, the space expander works with any stereo program source and even does an amazing job with old mono program sources... The ability of this new product to conjure up the feeling of listening in a live hall is incredible. One simply does not sense the presence of the extra speakers as such — only the feeling that the listening room has been vastly expanded in size.*

Robert Long (*High Fidelity, Feb. 1976*): *The overall effect is astonishingly realistic... We could turn our rather "dead" listening room into a small auditorium, a large concert hall, a cathedral, or even a cave.*

Harry Maynard (*The Gramophone, May 1976*): *The unit gives a remarkable "you are there" quality to any stereo source, allowing the user to expand and vary the sense of acoustic space to suit his own taste... Now enough people have heard digital delay systems to predict that they "will be the hottest thing to hit the hi-fi market in years."*

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AUDIO TECHNICA AT-11 •magnetic cartridge

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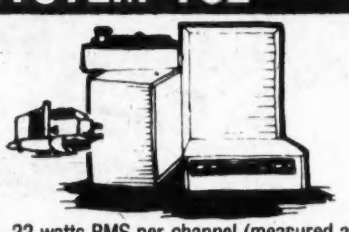

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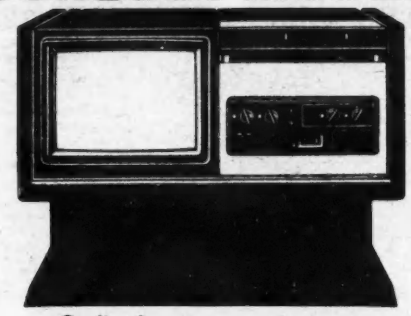

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MO

ACOUSTICAL PERFUME

White noise is like nothing you've ever heard

by Alan Grayson

Place a conch shell lightly against your ear and *listen*.

That's not white noise.

Now take the Green Line to Copley Square, make your way to the Hancock Building, slip past the security guard and *listen*. Listen to a sound that sounds just like your lover whispering into your ear.

That's white noise.

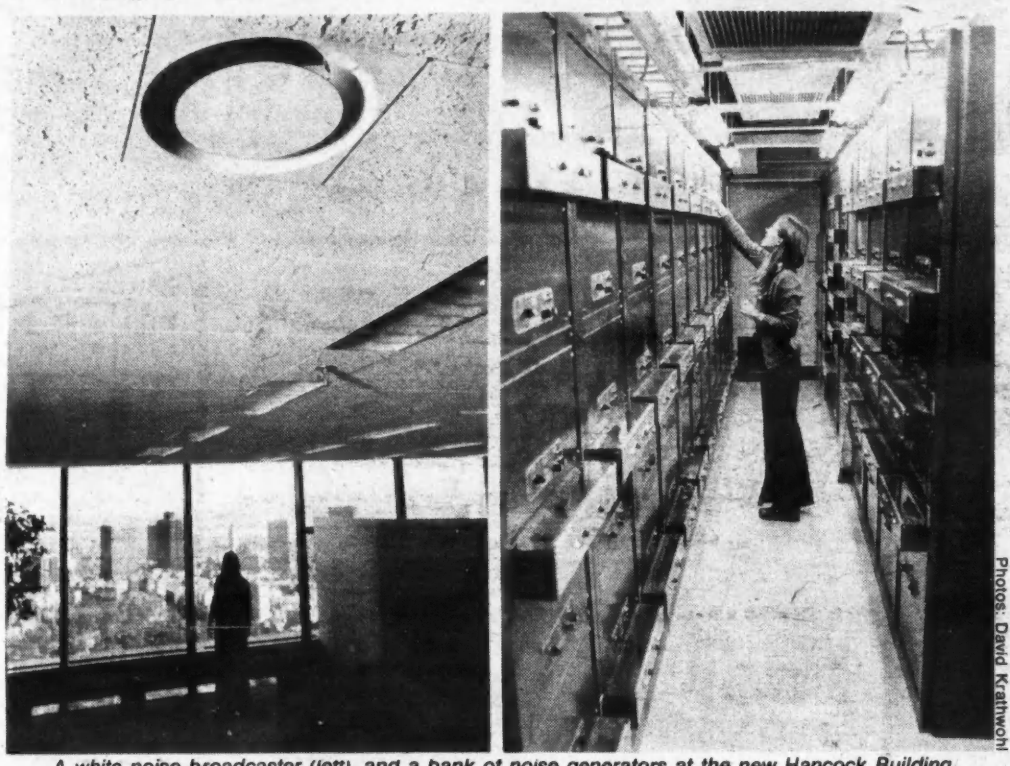
White noise is a very special sort of sound used in schools, professional offices and especially in business offices to tame noise and promote privacy. Its use is one aspect of a larger trend — a shift in office design away from the traditional 8' x 8' x 8' room toward the open landscaped office.

Until recently, stale antediluvian custom in office design decreed that walls must reach from floor to ceiling, ensuring unrelenting privacy for higher-level managers in their offices. This mixed blessing did not extend to less favored personnel who shared offices with obstreperous machines. Partly because of the terminal suffering of clerical workers, partly because of the isolation of management, but mainly because of the heavy carpentry costs of office modification, an alternative was sought.

Picture the *Washington Post* offices in *All the President's Men*. No walls; no privacy. The visual and aural cacophony of the open office lends an air of nervous agitation to any circumstance, but isn't very conducive to efficiency. Only claustrophobes and cost-benefit analysts are pleased. Management does not take kindly to sharing the clerical din.

Office landscapers postulate that the basic function of the office is the processing of information, and that the open office is best-suited to that end. But they recognize that concessions must be made to peace and quiet. Visual privacy is induced by strategic location of screens and planters. But acoustic privacy is another matter.

Rein Pirn of the Cambridge acoustical research firm, Bolt Beranek & Newman, estimates that conventional office walls will isolate between 30 and 60 decibels (dB), rendering a window air conditioner inaudible in the next room. But in the open office, an acoustical screen blocks out only 10 to 15 dB. Sound is clever. Most of it goes under or over or around a screen.



Photos: David Krathwohl

A white noise broadcaster (left), and a bank of noise generators at the new Hancock Building.

Pirn says that sound absorption by acoustically superlative screens, ceilings and floors might attain 25 dB of isolation between adjacent office subunits. But normal office noise ranges from 35 to 50 dB.

The background (ambient) noise of the open office could be reduced if business machines were hushed. But a tomblike ambient noise level would only accentuate the difficulty of keeping conversation *sub rosa* and less than distracting to others. The only solution short of instituting library rules in open offices is to *raise* the ambient noise level in order to drown out obnoxious background noise and insure privacy. This is called masking.

Masking was first studied in depth by Bell Laboratories half a century ago. Harvey Fletcher, reporting on that work in 1929, explained how masking works in this way:

"When the ear is stimulated by a sound, particular nerve fibers terminating in the basilar membrane are caused to discharge their unit loads. Such nerve fibers can no longer be used to carry any other message to the brain by being stimulated by another source of sound."

Masking raises the threshold of perception, rendering quieter sounds inaudible.

Bell studied the masking of pure tones by pure tones. A pure

Continued on page 28

If you're thinking about a new receiver, perhaps you should be thinking about separates.

Today's new receivers are more powerful and versatile than ever. But they're also bigger and heavier. And often less convenient to install than separates. What's more, as you already know, you can't upgrade just part of a receiver.

If you now want more power, more flexibility, better specifications and superior sonic performance, you should consider a separate amplifier and tuner.

The best way to find out is to let us demonstrate LUX amplifiers and tuners. We believe they sound better than anything else we have ever heard. Most of our friends agree.

So visit us and hear for yourself. At the very least, you'll enjoy the music.

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L-100 Integrated Stereo Amplifier LUX's most powerful: 110 watts minimum continuous power per channel into 8 ohms, 20-20,000 Hz, with no more than 0.08% total harmonic distortion throughout. Features include: exclusive linear equalizer for custom-tailored phono response; variable phono input sensitivity and impedance; three turnover frequencies each for bass and treble; 20-dB-range volume attenuator for each step of master volume control.

*Dolby is a trademark of Dolby Laboratories, Inc.

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F6

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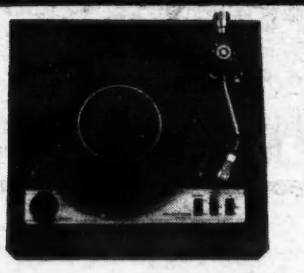

Garrard 990B
w/ base, cover and cartridge

~~$266~~ Dealer's List $129 Sale Price

LAUNDRY LIST

CASSETTE DECKS

Akai CS-34D	200	150
Akai CS39D	250	199
Akai GXC 75D	450	339
Akai GXC 325D	475	359
Marantz 5120	330	230
Marantz 5220	369	269
Sankyo 1510	240	125
Superscope 301	140	86
Superscope 302	190	99
Sony TC209SD (D)	500	350
Sony TC131 (D)	300	150
Technics RS676 US	460	325
Pioneer CTF2121	200	135

REEL TO REEL

Akai GX230D	500	319
Akai 4000DB	380	239
Akai 265	675	440
Sony TC377	400	279

Remember

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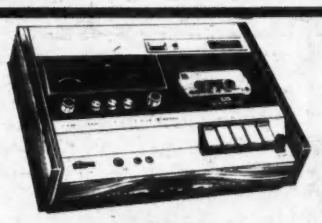
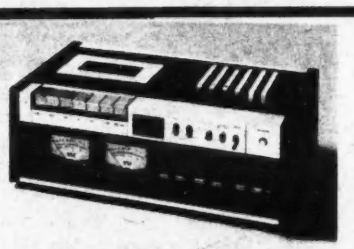


SUPERSCOPE
Deck 302A

~~$189~~ Dealer's List $99 Sale Price NO$TAX



TEAC A-450

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Dynaco 35 (D)	250	135pr.
Epi Mt-1 (D)	140	60pr.
Electrovoice B's	325	199pr.
KLH Barons	800	320pr.
Marantz HD-88 (D)	800	398pr.
Marantz HD-77	500	260pr.
Marantz HD-66	360	180pr.
Marantz 6G's	280	160pr.
Marantz 5G's	200	110pr.
Pioneer HPM-100	600	340pr.
Pioneer HPM-60	450	250pr.
Pioneer HPM-40	300	180pr.
Studiocraft 440	350	200
Studiocraft 330	220	150
Studiocraft 220	190	120
Turntables		
Dual 1225	163	99
Dual 1226	183	129
Dual 1228	220	130
Dual 510	230	119
Dual 601	280	199
Dual 701	400.	204
Marantz 6300	270	179
BIC 920	139	89
BIC 940	200	119
Garrard 990B	240	132
Garrard 770M	160	69
Garrard 440M	115	59
Receivers		
Sansui 881	450	299
Sansui 771	390	260
Sansui 661	300	190
Kenwood 5400	370	240
Kenwood 4400	300	200
Sherwood S7110	220	148
Technics 5150	230	149
Technics 5250	300	189
Pioneer SX450	200	144
Pioneer SX550	250	179
Pioneer SX650	300	211
Pioneer Spec 1	1400	840
Pioneer Spec 2	750	450
Marantz 2215	250	185
Marantz 2235	450	325
Marantz 2275	650	510
Marantz 2325	800	599

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HEADPHONES

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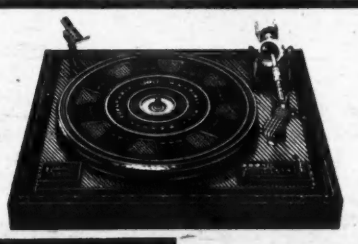

BIC 920
w/base, cover and cartridge

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NOISE

Continued from page 26

tone is a periodic pressure disturbance with a unique and constant frequency. A graph of pressure versus time for a pure tone would be a simple sine curve. A musical tone is a combination of pure tones of harmonically related frequencies and appropriate amplitude (volume or loudness). Office noise can be resolved into an aperiodic combination of pure tones of random frequencies and amplitudes.

White noise fills in the empty bands of the sound spectrum between the pinpoint frequencies of office noise. It shows equal energy or band-pressure level on any bands of equal width within a constant amplitude range. The range is chosen according to the sensitivity of the human ear. The ear is most sensitive to sound in the octaves centered about 1000, 2000 and 4000 Hz, where many people can perceive tones softer than 20 dB.

Within its range, white noise, a complex sound, masks office noise, another complex sound.

Measurements of the instantaneous voltage associated with a white noise band would yield a mean of zero and a normal distribution. Pink noise, an often-used variation on the theme, decreases logarithmically in band-pressure level as frequency increases so that it manifests equal band-pressure level among octaves, whose bandwidth increases logarithmically as frequency increases. In terms of decibels, a logarithmic scale, white noise increases 3 dB in successive octaves, while pink noise remains constant.

White noise is produced electronically by amplification of a sound producing an aperiodic signal. Originally the signal was produced by thermal agitation in a resistor or in a gas tube; today the sound element is usually a vacuum tube diode or transistor.

Some units marketed as white noise sources are mechanical, not electronic. An unscrupulous dealer could sell a noisy fan as a white noise source, but a mechanical device would produce periodic sounds. Because it would fail to cover audible frequencies *evenly*, it would be ineffective in masking.

There are other snares awaiting the unwary consumer. A manufacturer might include the signal-producing electronics in each white noise source. In most offices, where up to 100 units would be needed to complete a system, this is wasteful and expensive. Flexible and economical white noise systems offer a signal-producing master unit controlling several slave units.

If you work in a room that resembles a reverberation tank, a white noise system won't be very helpful, and money spent on a white noise system might be better spent on sound absorbent carpeting and tiling. Ideally, white noise is only part of an integrated acoustical environment.

Finally, the common admonition to consider the quality of parts and estimated maintenance costs when buying electronic equipment pertains to white noise systems as well.

Locally marketed white noise systems retail for about 30 cents to $1 per square foot of office space, depending on quality, quantity and profit margin.

One very new and very expensive local white noise system can be found in the Hancock Building, which features the most advanced office landscaping.

The Hancock white noise system was designed by Ranger Farrill & Associates of Irvington-On-Hudson, New York. In a November 15, 1974 editorial entitled "The Brave New Hum" the *Boston Globe* took note of the ability of white noise to render conversation at a distance of ten feet unintelligible. "A critic," said the *Globe*, "might inquire from old-fashioned naivete, 'Given the daily slaughter of the English language throughout the land, would it be a worthier objective of technology to render human conversation intelligible?' " (The *Globe* is an expert in old-fashioned naivete.)

An unscientific survey of Hancock employees taken as I was escorted through the building by a member of the insurance company's Public Relations department showed the workers to be profoundly neutral in opinion, having no basis for comparison. With one exception.

"This gentleman," said my escort, "would like to know how you feel about white noise —"

"Oh, I prefer more music. More music."

"— He's from the *Phoenix*."

"It's just fine as it is."

Later, a Hancock PR functionary offered to answer questions.

"Employees don't seem to have much of a reaction to the system," we noted.

"How can you react to nothing?" she said. "It's very subtle."

"Has there been any negative response?"

"I don't think that I . . ."

"Pardon?"

"See how well the white noise works," she giggled.

Despite the reticence of Hancock employees, and though white noise can do much to make the open office livable, the installation of a white noise system can induce a less than euphoric reaction among personnel. Bob Nichols of Nichols Dynamics, parent company to a white noise systems manufacturer, says of employee response, "Probably some would like it; perhaps some wouldn't. Some people like to hear what other people are saying." Another engineer believes that employees project their negative feelings onto the system.

To minimize negative response, Nichols recommends that the white noise system be automatically controlled by the lighting system or a sound level meter, eliminating the possibility of employee interference. He suggests installation in currently occupied offices be done on weekends "when no one is around."

Nichols's practical experience regarding the real and imagined reservations of employees is documented by A.C.C. Warnock in a study for the *Journal of the Acoustical Society of America*. Warnock found that when the occupants of one office were asked whether they preferred the ordinary office milieu to the less spasmodic but louder white noise audio environment, "this group consistently preferred less noise." He reports that "the results obtained . . . were somewhat of a surprise to the experimenters. The office staff unequivocally rejected the masking noise system." Warnock's results are at odds with another experiment (by L.W. Hegvold), when employees were allowed to control their masking device and set it, by trial and error, to 48 dB, but two inherent limitations on the effectiveness of white noise are suggested.

First, tastes vary. Groups of employees can have different needs and different desires for privacy. While some employees might want a strong white noise barrier, others, like Warnock's group, might prefer no barrier at all.

Second, as Hegvold points out, communication and privacy are inverse quantities. Privacy is increased by white noise only at the expense of a higher ambient noise level. Although white noise regulates the trade-off between silence and privacy, it does not alter the terms of trade.

White noise can only mask noises up to a few dB below its volume. It offers relief from the distraction of intermittent sounds but not from the distraction of louder noises. White noise isn't quieter than the sound it masks, it is only steadier.

Hegvold's experiment indicates that the maximum comfortable white noise volume is 48 dB. Above that point, the cure becomes less tolerable than the disease. Privacy and freedom from distraction can only be ensured when office noises remain below 48 dB. In the open landscaped office this can only be done by increasing the space between subunits. And space is at a premium.

Psychological resistance to white noise volumes greater than 48 dB insures the concept against a graver charge. It's fairly certain that at 48 dB white noise sources don't rate a Surgeon General's label. Klaus Kleinschmidt of Cambridge Acoustical Associates says that although white noise hasn't been rigorously tested for long-term effects, no one would claim that it's harmful to the ears or the nerves. The 48 dB barrier is well below the standard set by the American Academy of Ophthalmology and Otolaryngology, which places the safety limit at 85 dB for periods greater than five hours a day.

So white noise has a fundamental, though limited role in making the open office a more pleasant milieu. The ultimate effect of the concept on the institution can be inferred from the comment of one Hancock employee on the impact of the system on office gossip.

"*Plus ca change . . .*," she said, and winked.

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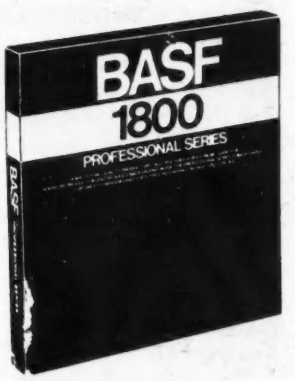

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†Technics recommended price, but actual retail price will be set by dealers. *New IHF '75 standard

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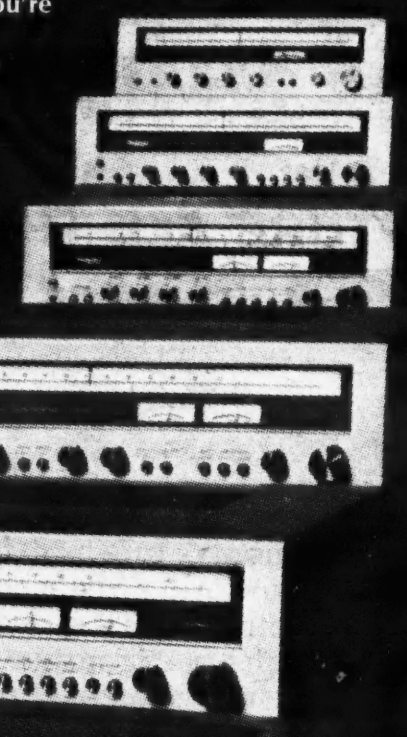
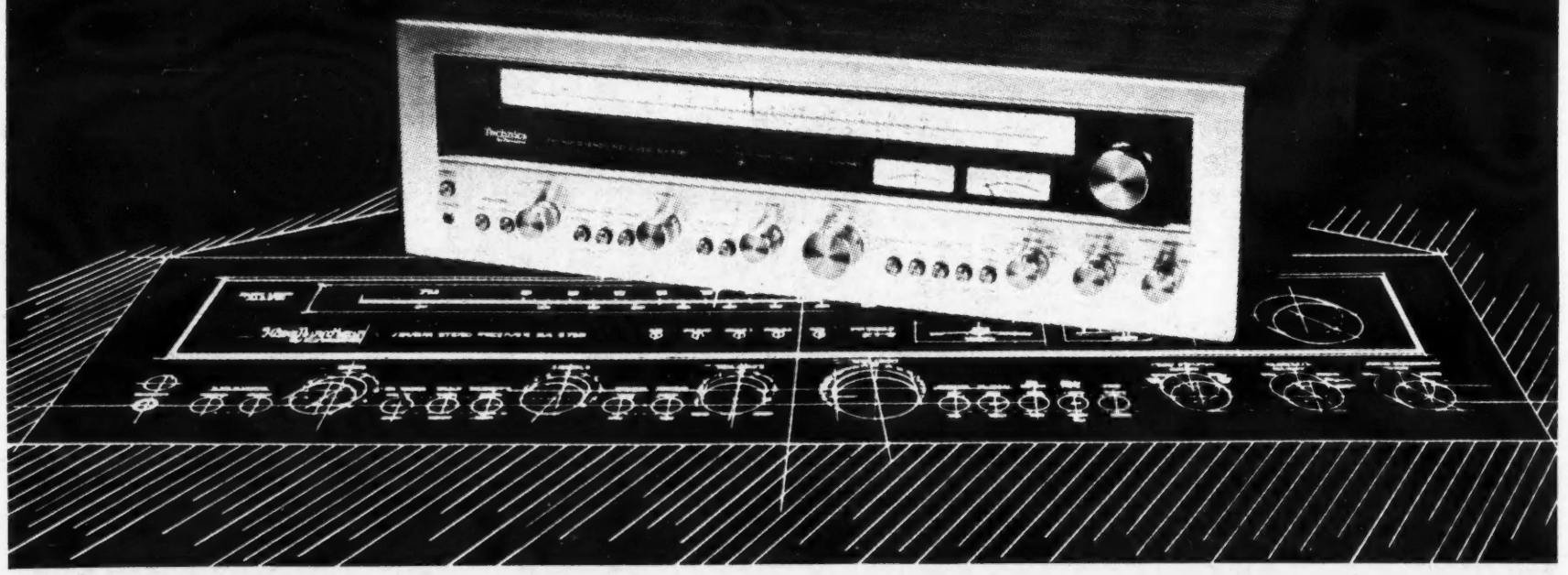




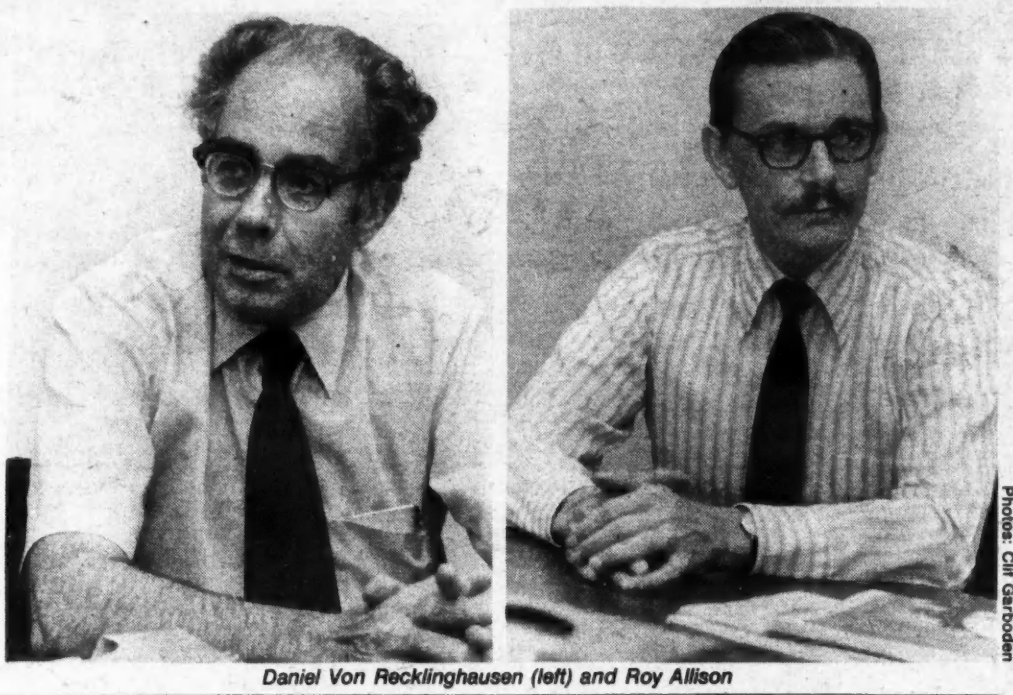
WHERE CREDIT IS DUE

Boston's place in hi-fi history

by Michael Riggs

By now everyone is accustomed to stereo and high fidelity (the former doesn't necessarily imply the latter), though both are relatively new developments. And probably most of you know that more than 20 manufacturers of hi-fi equipment call the Boston area "home." What may not be obvious is how important those particular companies have been in making the public familiar with the joys of well-reproduced music.

Stereo was actually developed in the youth of high fidelity, but the market was initially small, limited to those people who were willing to pay for and to put up with enormous loudspeaker systems and who didn't care that all discs and radio broadcasts were mono. It's in the area of stereo that Boston audio experts have made their special contribution, time and again, right down to the present.



Daniel Von Recklinghausen (left) and Roy Allison

Photos: Cliff Garboden

They made available the technology that has brought high fidelity, stereophonic reproduction to millions.

Our story opens in the early '50s. Henry Kloss, then an undergraduate at MIT, had a loft in Cambridge where, under the modest ensign of Kloss Industries, he built speaker enclosures following a design developed by two MIT professors. In those days, people often bought drivers and enclosures separately, not realizing how interdependent the two are. The particular enclosure Kloss manufactured was considered remarkable for its ability to elicit bass response below 100 Hz from a variety of small speakers.

While Kloss was in the Army at Fort Monmouth, New Jersey, he left his business in the hands of his good friend and customer Tony Hofmann, a physicist and the son of pianist Joseph Hofmann. It was during his stint in the service that Kloss met Malcolm Low and took Edgar Villchur's course in sound reproduction at New York University.

Villchur's approach was to look at the reproduction chain one link at a time, beginning at the end (the loudspeaker). He was keenly aware that one of the most significant impediments to the achievement of high fidelity reproduction was the difficulty of obtaining good bass response from loudspeakers. Systems then available usually had not only limited deep bass response but plenty of distortion as well, the product of the nonlinear cone suspensions then in use. Bass distortion components would intermodulate with signals throughout the range, causing blurred, muddy sound.

Villchur knew that much work had gone into improving those offending suspensions, to little avail. Consequently, his solution was a radical one: using trapped air to provide a very linear restoring force. At first he intended to use a system of chambers and pistons, but soon he realized that none of that was necessary — just the enclosure, which would become an integral part of the speaker system. He installed a floppy, low resonance cone in a small, sealed box, and the acoustic suspension loudspeaker was born.

Villchur took his little wonder around to a few people in the industry, who weren't interested. Finally, in 1953, he invited Kloss, who had become his friend as well as his student, to his home in Woodstock, New York, to hear the device. Kloss was very impressed. The speaker produced deep, undistorted bass and *had* to be small to do it. He convinced Villchur — never a man much enthused with business — that they should manufacture it. With Hofmann and Low and very little capital, they went into production, and Kloss Industries became Acoustic Research.

Needless to say, AR was a success, but Kloss wanted to run his own company. He made an arrangement with Villchur and in 1957 set off with Low and Hofmann to start KLH. Their first products were loudspeakers, including the Model Six, perhaps one of the most popular speakers ever made. Kloss designed the Six, which became the reference to which all future KLH speakers were held, to have the

Continued on page 38

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The Garrard 990B. And the argument ends.

There are almost no limits to what you can spend for a turntable. Nor to the refinements that can be built in.

The argument has been whether you can find a turntable at a sensible price, that really performs—giving away nothing important. Now with the belt-driven 990B, the argument is over. The 990B gives nothing away in any vital area, yet is priced to make it eminently accessible.

We believe the 990B is the best value Garrard has ever offered in its quarter century of designing and manufacturing high fidelity turntables.

The 990B is a single-play/multiple-play turntable and is fully automatic in both modes. That is, its arm indexes, returns to its rest and shuts off automatically. All of which is more dependable than a hand . . . that can be shaky or careless. And the mechanism that does all of this is disengaged *during* play. You get the gentlest handling of records *plus* convenience.

But more. In the multiple-play mode, your records rest on a *two* point support. You don't have to balance them on a single center support. And pray.

And still more. A precision anti-skating device eliminates distortion and record wear caused when the stylus is forced against the inner wall of the groove by rotation of a record. Even cueing is viscous damped in *both* directions.

All well and good. But what about performance?

A glimpse at some specifications tells the story. Rumble: −64dB. Wow: 0.06%. Flutter: 0.04%. These are possible because your records are cushioned on a full size, 5 lb., die-cast, dynamically balanced platter —belt driven by a motor that *combines* an induction rotor for starting power and a synchronous section for constant speed. You can even solve the problem of off-pitch recordings with the variable speed control monitored by a strobe disc.

One final word. The S-shaped, lightweight, aluminum tonearm boasts low mass and low friction. But here's the thing. The 990B's tonearm can track as lightly as ½ gram. Protection and performance indeed.

There are other turntables in the price range of the 990B that offer *some* of these features and specifications. The 990B has them *all* and at a price that's sensible—under $170!

Which clinches the argument.

For a copy of the Garrard Guide, write: Garrard, Div. of Plessey Consumer Products, Dept. A, 100 Commercial St., Plainview, New York 11803.

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NEW PRODUCTS

Sound Guard

The record collector's number one problem — record deterioration through normal playings — has now been solved.

The new record preservative is a spinoff of technology developed by Ball Corporation for aerospace application. It is dry lubricant in a liquid spray form.

The new preservative is sprayed on the record, then thoroughly buffed, leaving less than three-millionth of an inch coating. While maintaining the highest fidelity, this micro-thin coating markedly reduces needle wear on record surfaces by providing a protective film without a buildup of coating material on the disc. Sound Guard preservative also contains cleaning and anti-static properties.

Sound Guard is packaged in a two-ounce bottle with a spray pump. A buffer is built into the top of the packaging. One kit will treat approximately 25 lps, both sides. Suggested retail price of kit is $6.99. Also available for $4.69 is a refill, containing the two-ounce bottle and spray pump.

Pioneer's CT-F8282

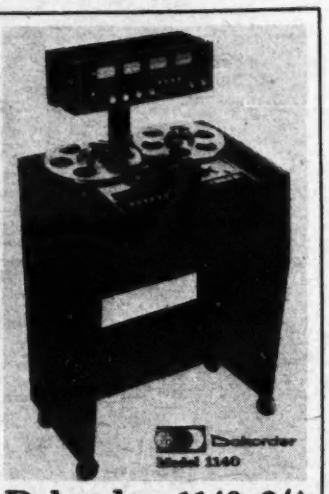
Pioneer's new front-access, two-motor stereo cassette deck, the CT-F8282, is a versatile unit. Its front-loading design, which positions the tapes vertically and holds them securely with a twin-link mechanism, offers convenience (without sacrificing quality) over top-loading cassette decks.

The CT-F8282 has an electronically controlled motor for stable tape transport in play and record modes, and a DC high-torque motor for fast forward and rewind.

The unit's wide dynamic range, low distortion and wide frequency range are achieved by its NPN-NPN-NPN, three-stage, direct-coupled head amplifier.

Other features on the unit include a high-performance ferrite-solid record/play head, ferrichrome/ chrome/ standard EQ and Bias, Dolby NR, memory stop, peak level indicator and large VUs. Specifications are outstanding.

Price: less than $400.



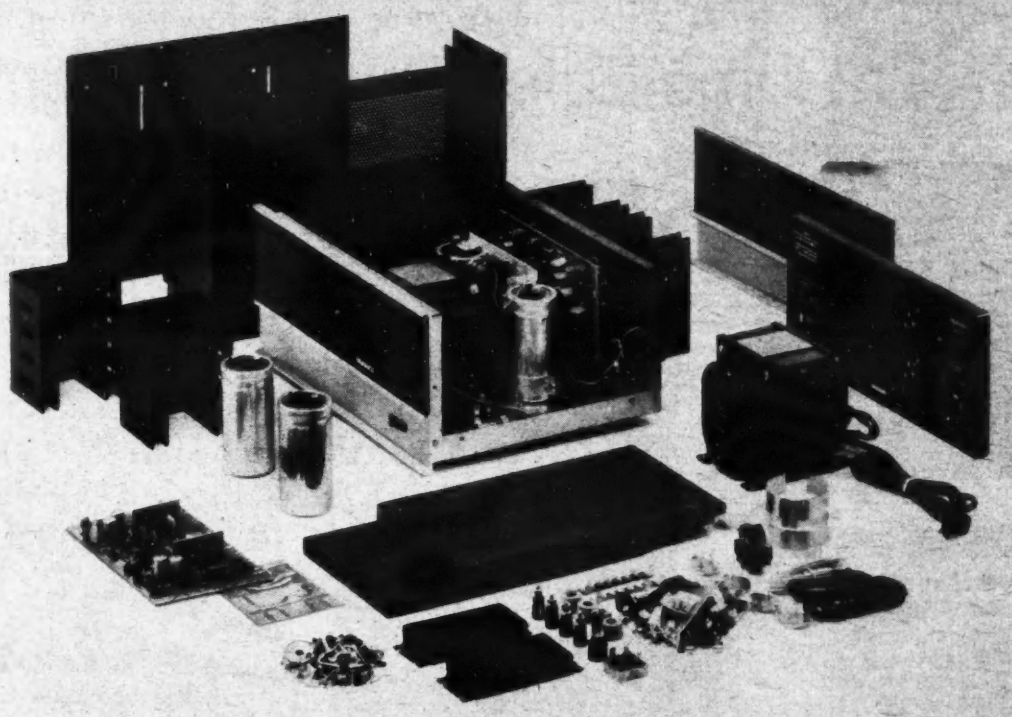
Dokorder 1140 2/4 channel tape deck

The Dokorder 1140 was designed so that you can concentrate more on your music and worry less about how it's getting onto tape. It won't take the engineering job completely off your hands, but many of the frustrations of multi-track recording — the getting in and out of synch, the search for the beginning of program material, setting up proper bias, and so on — have been eliminated. In short, you won't have to divide your attention between the demands of your music and the demands of your tape recorder.

What's more, the 1140 sounds as good as it works. The record, bias and reproduce amplifiers were designed with great care to give you the lowest possible apparent noise and the highest possible transparency.

It has, among other features: automatic multi-synch; program memory; fail-safe touchbutton controls; peak level indicators; and a built -in pink noise generator to give you a simplified but much more accurate way to get optimum bias for the tapes you use.

not everyone could build a stereo kit...



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If you've been scared away from stereo gear in kit form, let the new Stereo 150 amplifier change your mind. It's the superb new power amplifier from Dynaco—hi-fi kit specialists for 20 years.

The Stereo 150's preassembled circuit board pretests 90% of the audio circuitry so you *know* it'll work right before you open the kit. Plus saving $120 in two evenings with screwdriver, pliers and soldering iron. You'll have the best *sounding* power amp going . . . DC coupled, full complementary symmetry 75 watt/channel* output, a massive power supply to handle peaks perfectly, and the biggest heat sinks per watt.

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The Dual CS 721

The new CS 721 has a tonearm with more refinements than any other tonearm ever made. The most innovative feature of the CS 721's tonearm is its adjustable height. This allows the tonearm to parallel the record without the use of cartridge spacers otherwise needed to accommodate various size cartridges. The correct tracking angle is thus achieved without adding to effective tonearm mass. Cartridges are also easier to mount and interchange.

Other features and adjustments of the gimbal-mounted tonearm include: adjustable cuing height and descent speed; continuous play in addition to manual and fully automatic start and stop. As with all Dual tonearms, stylus overhang is adjustable. Stylus pressure is applied around the vertical pivot to maintain dynamic balance in all planes, and anti-skating is calibrated separately for conical, elliptical and CD-4 styli.

Another major refinement of the CS 721 tonearm is an antidote for acoustical feedback. Two mechanical anti-resonance filters are housed within the counterbalance. One filter cancels the resonance of the tonearm/ cartridge combination; the other, the resonance of the chassis.

The CS 721, the best turntable Dual makes, is powered by an electronically regulated direct-drive motor with Hall-effect speed monitoring. The two speeds, 33 1/3 and 45 rpm, can be varied over an 8% range, and read from an illuminated strobe on the platter rim. The performance specs are unsurpassed.

The approximate price is below $400, including base and dust cover.

The first hi-fi car stereo

Nakamichi Research and Analog & Digital Systems (ADS) announce their state-of-the-art stereo system, designed for use mainly in automobiles, boats and planes, consisting of the Nakamichi 250 Cassette Player and the ADS 2002 miniature loudspeaker system. The prodigious performance of this system promises to upset the popularly held notion that true high fidelity is wasted in automobiles.

The Nakamichi 250 Cassette Player is a component grade playback-only deck featuring mechanical and electrical excellences that separate it from all other automobile cassette players — not to mention most home-use decks. Its Crystal Permalloy playback head, servo-controlled DC motor drive and advanced circuit design assure a level of performance generally considered unattainable in a unit of such compact dimensions. Front panel switches allow the selection of either 70 or 120 microsecond equalization and Dolby Noise Reduction "in" or "out". A built-in preamplifier provides volume, balance and tone controls.

An off-spring of the renowned ADS 2001 car speaker system, the ADS 2002 is small enough to fit in the palm of one's hand, but in terms of its accuracy, it is the equal of monitor loudspeakers many times its size and price. The 2002 is a bi-amplified system (separate amplifiers for the woofer and tweeter, with an electronic crossover). It employs a super-long excursion four-inch woofer and a one-inch soft dome acoustic suspension tweeter. ADS engineering breakthroughs have allowed the 2002's power amplifiers to be built into the speaker cabinets. The maximum SPL output of the system is only three dB less than that of the ADS 2001, and the power amplifiers are of the advanced low distortion design. The system's ability to provide a clean output at high power levels allows it to overcome the high ambient noise levels encountered in many automobiles.

The cables supplied with the Nakamichi 250/ADS 2002 system are wired so that interfacing is accomplished with a single connector. The mounting brackets, furthermore, have been designed so that the entire system can be easily detached and used indoors with optional AC adaptors.

Price: less than $1075.

The Audio/Pulse Model One Digital Time-Delay System

The Audio/Pulse Model One is a new kind of stereo component: a digital time-delay system. It expands and varies the sense of acoustic space in a listening room, effectively "dissolving the walls" and recreating the sense of listening in the kind of public environment where live music is usually performed. It can make anything from a single guitar or singer to a rock band to a full-size symphony orchestra sound as if it's being heard in its natural setting.

Using techniques developed in computer technology, the Model One adds multiple time-delays to the original sound of a record, tape, or broadcast. It effectively duplicates the way in which delayed, reflected sounds produce the richness and depth of a live listening experience in public.

The Model One is designed for use with any standard stereo or mono musical material. The delayed signals it creates are intended to be fed to a second amplifier and heard over a second set of speakers placed to the sides or rear of a liistening area.

It is the first product we know of that can make the restricted acoustic environment of a living room sound convincingly like a concert hall or cathedral or theater or night club.

AR-14 loudspeaker system

The AR-14 closely approaches the musical accuracy of the most expensive AR speakers at a significant saving in cost. It combines the superior bass performance of the AR-12 with the energy response of the AR-16.

The AR-14 employs a 10-inch acoustic suspension woofer installed in a cabinet of the dimensions normally used for AR 12-inch units. The result is bass performance with extended range and very low distortion that is more than adequate for all music except perhaps the most demanding organ or electronic music recordings.

An appropriate balance between flat energy response and flat anechoic response enables the AR-14 to reproduce music with a high degree of accuracy under most listening conditions. In fact the AR-14 is uniform in its radiation over nearly as wide a range and solid angle as are AR's most expensive speakers.

This uniformity of response has been achieved by means of a crossover network designed with the aid of AR's large reverberant chamber located at their British laboratories.

This new chamber, together with the polyhedral chamber at the factory near Boston, permits a new level of reliability in the measurement of a speaker system's total energy output and to refine its design with considerable precision.

The cabinet molding of the AR-14 has purposely been kept small in order to eliminate audible interference effects that are normally caused by sound waves being reflected from cabinet projections.

Audio-Technica AT15Sa cartridge

The chances are good that when you first bought a stereo system, it was a "package" that included a receiver, 2 speakers, and a record player with cartridge. But how much time was spent selecting the cartridge? Even if it had a famous name, it probably was not a truly first-rank model.

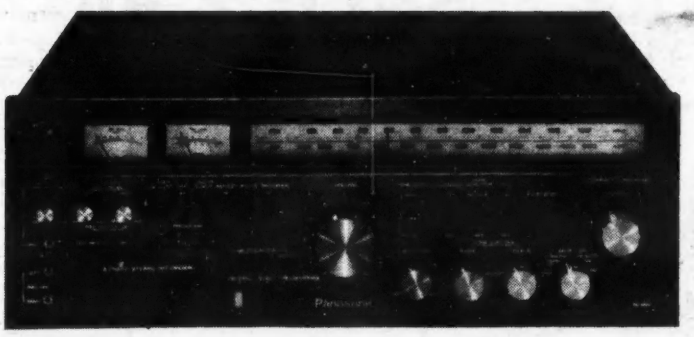
Yet the cartridge is more important than that. It can limit the ability of the entire hi-fi chain to properly reproduce your records. It can affect how many times you will enjoy your favorite records without noise and distortion. And it can determine whether you can play and enjoy the new four-channel CD-4 records.

Consider the advantages of adding an Audio-Technica AT15Sa to your present system. You start with response from 5 to 45,000 Hz. Ruler flat in the audio range for stereo, with extended response that assures excellent CD-4 playback if desired. Tracking is superb at all frequencies and distortion is extremely low. The sound is balanced, transparent, effortless. Stereo separation is outstanding, even at 10kHz and higher where others fall short.

And the AT15Sa has a genuine nude-mounted Shibata stylus. Which adds a host of advantages. Like longer record life. Better performance from many older, worn records. Exact tracing of high frequencies, especially at crowded inner grooves. And tracking capability — at a reasonable 1-2 grams — that outperforms and outlasts elliptical styli trying to track at less than a gram.

The AT15Sa: very possibly the last phono cartridge you'll ever need.

Panasonic Home Entertainment System



RA-6600

FM/AM/FM Stereo Receiver with Built-in 8-Track Player/Recorder. Power: 12 watts per channel, 40 Hz–20kHz, 0.8% total harmonic distortion. ITL-OTL-OCL circuitry. FET RF tuned FM tuner with IC and ceramic filter. Illuminated linear scale tuning. Tuning meter/Flywheel tuning. AFC on FM/Stereo-eye. 41-detent volume control. Loudness switch. Speaker selector switch. Auto/manual recording level control with two volume controls. Auto-Stop/Auto-Eject. Two level meters for recording. Tape monitor switch. 8-track 3-digit time counter. Mic mixing with volume control. Simulated wood cabinet.

thrusters

SB-1600

Thrusters Speaker System. 10″ high-efficiency woofer. 10″ passive radiator ("vibra-cone"). 2½″ tweeter. Passive radiator tuned frequency 20 Hz. Crossover frequency 3 kHz. Maximum power input 40 watts. Impedance 8 ohms. Simulated wood cabinetry.

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NEW PRODUCTS

B.I.C. 1000 Electronic Multiple Play Manual Turntable

British Industries Company, developer of the belt-drive multiple play turntable concept, has introduced a new top-of-the-line unit, the Model 1000 ELECTRONIC.

The B.I.C. 1000 ELECTRONIC incorporates two motors. A smooth-running 24 pole 300 rpm synchronous motor is used to drive only the turntable, while a second motor controls the cue and change cycle.

Operation of the Model 1000 ELECTRONIC is unique. The turntable stops rotating when cued or in cycle. This facilitates reading the record label and provides more precise cuing control. The use of two motors improves the performance specifications found in other B.I.C. models.

A printed circuit board, whose electro-mechanical components function like a digital computer's controls the cue and cycle operation. Electronic touch buttons initiate all actions and LEDs illuminate to indicate the operations that are taking place.

The unit has an optional wired or wireless remote control which duplicates all of the functions performed by the touch buttons on the unit plate, including cue, pause, reject and change of records.

The B.I.C. 1000 ELECTRONIC has a suggested retail value of $279.95.

Empire 698 turntable

This new Empire turntable is the latest refinement of the basic belt-driven manual turntable the company has been making for 15 years. The outstanding developments in this model are its considerably lower-mass tone arm and its gentle electronic cuing and arm lift-off when the record is over (hitherto these operations had been performed mechanically). Otherwise, it has retained essentially the same motor, platter, belt-drive and bearings — all of which in the past made former Empire models test out as having among the lowest wow, flutter and, especially, rumble specifications in the industry.

Other niceties include quieting on-off circuitry, extremely fine anti-skating and stylus-force gauges, 32 sapphire bearings for the tonearm, and more. But essentially what is being introduced this year is improved performance. The idea is evolutionary.

With proper maintenance, the Empire 698 is very probably the only turntable you'll ever need. Suggested retail price, $400.

The Teac A-100

TEAC Corporation of America has introduced its first high-performance, moderately priced front-load stereo cassette deck, the A-100. Specs are what you expect from Teac.

A DC servo-controlled capstan motor, not affected by changes in the line voltage, drives the tape in a lighted cassette compartment. The A-100 has Dolby noise reduction and independent 2-position bias and equalization selectors, which provide compatibility with the newest tape formulations.

The new unit has a special switchable timer function that, when connected to an external timer, will activate the machine in the record mode when no one is present.

Additional features include large VU meters, digital tape counter, friction-coupled record level control, stereo headphone jack, and front panel microphone inputs.

Less than $200.

Accura 4000

The most advanced electronic turntable which operates by remote control and allows random track selection — has been introduced by Audio Dynamics Corporation, a BSR Company.

The ACCUTRAC 4000, the first of the units available for consumer purchase, consists of three separate but interrelated component pieces: the automatic, direct-drive electronic turntable, a sleek remote receiver, and a hand-held cordless transmitter. From the comfort of any easy chair, listeners can now program tracks indicated numerically on the transmitter. The message is then transmitted to the receiver, which is located in convenient proximity to the turntable, and the receiver in turn activates the turntable's arm, which places the stylus precisely at the beginning of the track selected by the listener. The receiver's LED winking "eye" lets the listener know that the information has been received and held in total memory.

Up to 24 commands can be programmed in any order the listener desires. He may also program the transmitter to reject, cue, repeat and clear, as well as play. Virtually all a listener has to do is place the record or disc on the turntable. From that point on, he can relax. Track selection can be determined by a quick look at the album jacket, and favorite selections can be repeated over and over again without the listener's ever having to move an inch.

The unit's "regular" specifications are state-of-the-art; it comes with a special version (with optical sensing components) of the ADC XLM Mk II cartridge. Price: less than $500.

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ALL OTHER 698 ALBUMS ARE ON SALE FOR $3.99 OTHER ALBUMS PRICED PROPORTIONATELY. AND DON'T FORGET TO VISIT OUR NEW TAPE DEPARTMENT.

DISCOVER INVISIBLE SOUND.

Introduction:

The most important decision you make when buying a stereo system is your choice of speakers.

This is because speakers directly influence the sound of a stereo system more than any other component.

Differences between equivalently-priced receivers and turntables are difficult (if not impossible) to detect in the home, but differences between good and bad speakers can spell the difference between pleasure and disappointment in your stereo investment.

To help you make a better choice, we'd like to describe some of the things we've learned about speaker design, and point out some of the unique features of our speakers.

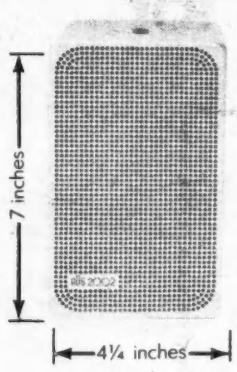
But, First, A Word About Ourselves . . . .

We're an American manufacturer with facilities in Wilmington, Massachusetts, a few miles north of Boston.

Our background is in the recording studios and concert halls of Europe, where for over ten years our speakers have been used in the most critical monitoring applications.

Our commitment is to use technology in the service of music—to come out with the best-sound speakers we possibly can, as well as investigate ways of bringing music into new environments . . . as witness the development of our ultra-miniature, bi-amplified, two-way speaker designed for cars, vans, and other 12-volt DC applications.

We're one of the few speaker manufacturers who build our own woofers, tweeters, and crossover networks. Only in this way can we achieve the performance and consistency we aim for.



Our ADS 2002 stands less than 7 inches high, is just 4¼ inches wide. Yet it contains two built-in power amplifiers—one for the woofer, one for the tweeter! (Also available without power amps.)

The L 710 (above) is one of six bookshelf (or slightly larger) ADS speaker systems. All use the same low-mass one-inch dome tweeter.

The More You Know About The Way We Build Our Speakers, The More You'll Appreciate Why They Sound So Good!

We at ADS design and build for accuracy.

We don't agree with manufacturers who build for an "East Coast Sound" or a "West Coast Sound." The only "sound" we aim for is the sound of the original performance.

This is because we have found that the only type of speaker you can live with and enthusiastically enjoy for many years is a truly accurate speaker. Dramatic, larger-than-life speakers that over-emphasize one part of the music at the expense of another usually end up in want-ad columns and used-equipment departments.

In addition to designing for accuracy, we aim for excellent transient response. Transient response refers to the ability of the speaker to quickly respond to the music.

The overall term for our emphasis on accuracy and transient response is Invisible Sound. We say our speakers offer Invisible Sound because the more you listen, the more you're aware just how little our speakers come between you and the music.

Here Are Some Of The Ways We Achieve Invisible Sound.

***All ADS speakers use the same one-inch dome tweeter!** The extremely low mass of our tweeter (less than 0.2 grams) permits our speakers—all of them—to resolve the tiniest bit of musical detail with you-are-there realism.

***The dome design of our tweeter and mid-range units delivers an ideal stereo image.** You can pinpoint the location of the individual instruments you are listening to!

***Two woofers are better than one!** Most ADS speakers use two small woofers, instead of one big one. Again, the benefit is lower mass, so you can enjoy boom-free, detailed bass response.

Which Model Is Best For You?

We don't feel you should have to buy our most expensive model in order to enjoy good sound. Accordingly, all of our speakers are built to a single standard of excellence, all use the same one-inch dome tweeter, and all must pass a one-hundred percent "Zero Defects" quality control inspection.

Which of our models you should choose depends mainly on how loud you listen to music, and how important the bottom half-octave of music is to you. (Our larger models can handle a bit more power—so they can be played louder—and they offer better reproduction of the very lowest bass fundamentals.)

One thing you can be sure of: whichever ADS speaker you choose, you'll be taking home a quality product, built without compromise, and designed for many years of pleasure.

An Invitation . . . .

There's more we'd like to tell you about ourselves, and our speakers, but—like with most things in stereo—the ultimate test is in the listening.

So we'd like to invite you to one of our dealers listed below, and listen to our speakers. Listen on all types of music, at all levels. Listen as long as you like.

We think you'll be impressed.

Our speakers won't overwhelm you, they'll underwhelm you. After you listen awhile, you'll realize that what you're hearing is the original music—the speakers have disappeared!

At that point, you'll be experiencing Invisible Sound.

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Hear ADS Speakers At The Following Component Specialists:

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EARDRUM
Harvard Sq.
Burlington

MAINE AUDIO
Waterville, Maine

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Bangor, Maine

TRIPOD AUDIO
N. Hampton, Mass.

TWEETER ETC.
All Locations

THE VANISHING WARRANTY

Count your blessings instead of change

by Peter Mitchell

A striking pattern in hi-fi merchandising recently has been the virtual disappearance of the advertised guarantee. Ads and brochures which formerly included as a matter of course a reference to "our gold-clad five-year guarantee" or "guaranteed one year parts and labor" now make no mention whatsoever of a guarantee. This is not an accident nor a conspiracy; it may even have a good side.

The disappearance of guarantees is a result of a congressional act. Congress passed the Magnuson-Moss Warranty Act two years ago and its provisions have gradually taken effect this year. It established basic requirements for legal product warranties and authorized the Federal Trade Commission (FTC) to add additional warranty standards as it sees fit.

The new law is intended to strengthen the consumer's position vis-a-vis the manufacturer or store. It grants the FTC nearly unlimited power to regulate warranty practices, and attempts to close the loopholes which some manufacturers have been writing into their warranties. Historically, the principal intention of written warranties has been to *reduce* the manufacturer's liability for the consequences of product defects.

In common law, if a product is sold without a specific warranty statement, it automatically carries an "implied warranty": the product is assumed to be fit for its intended purpose and the seller is obliged to fix or replace it should it fail to fulfill that purpose. Written warranties exist to cancel the implied warranty and replace it with a more restricted obligation. The new Warranty Act was motivated by the widespread use (mostly outside the audio industry) of warranties so deviously written that they duck nearly all manufacturer responsibility.

Oddly, the new law seems to discourage the use of the word "guarantee." A more substantial result is that henceforth the published warranty on any product costing more than $10 must state explicitly what the warranty covers, for how long, and how the buyer can get the warranty honored. Manufacturers are also supposed to label their own warranty as either "Full" or "Limited." In order to be described as Full, a warranty must meet Federal standards; if it doesn't, it must be identified as a Limited Warranty.

Naturally, every manufacturer would like to be able to advertise that his products are provided with a Full Warranty. But since the Magnuson-Moss Act is still new and its legal implications haven't yet been tested in court, most manufacturers worry about their vulnerability if they adopt a Full Warranty policy. Essentially the federal standards on Full Warranty status appear to embody the philosophy that "the customer is always right." Many manufacturers feel that the new law goes too far and could become too costly for them, particularly if the FTC turns out to be bullish in its interpretation and enforcement of the rule. So to be on the safe side — at least until the legal implications of a Full Warranty policy become clear — most manufacturers are providing Limited Warranties on their products. To date only a few hi-fi manufacturers (ones who would have offered unlimited free repair of their products even if the new law hadn't passed) have chosen to risk offering a Full Warranty on their products.

Of course, no one wants to advertise that his products are covered only by a Limited Warranty — so most companies no longer mention warranties at all in their ads. Thus a government action intended to be beneficial to consumers has had the effect of *reducing* the amount of information readily available to consumers. A similar side effect occurred when the FTC chose to regulate the advertising of amplifier power ratings; many manufacturers now feel compelled to omit some of the power-output information (e.g., for 4-ohm and 16-ohm impedances) which they used to publish.

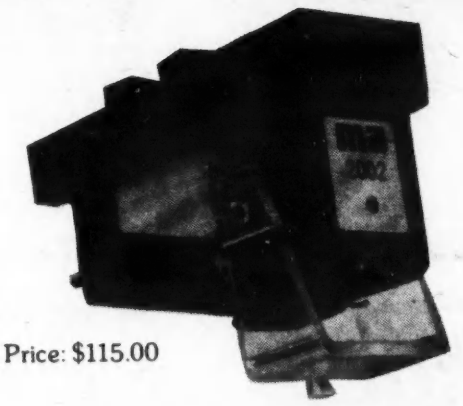
Obviously, a Full Warranty provides a fairly strong assurance of a manufacturer's confidence in his product, implying that you can safely expect that the product will not prove costly or troublesome — assuming, of course, that the manufacturer actually *will* honor the terms of his announced warranty. But the converse is not necessarily true. It does not necessarily follow that a Limited Warranty provides only a weak assurance of a manufacturer's willingness to stand behind his product. Many companies which have had relatively generous service policies will continue to have them, even though their written warranties may be described as Limited.

For example, if a warranty's benefits are extended only to the product's original owner, (the person who buys the product factory-fresh from an authorized dealer), it must be identified as a Limited Warranty no matter how generous the actual terms of the warranty may be. A Full Warranty's benefits must be made equally available to people who buy the product second-hand or third-hand.

In any case you should read the terms of the warranty itself. You may find, for instance, that a five-year Limited Warranty provides more benefits than a two-year Full Warranty if the long Limited warranty doesn't contain too many exclusions.

And regardless of the terms of a warranty, Massachusetts citizens have additional protection available to them. The state's consumer protection laws are substantially stronger than federal statutes. If you feel victimized, you can call the consumer protection division of the Attorney General's office. While they don't have enough staff to keep up with all of the consumer complaints they receive, they sometimes can provide help.

Because good tracking isn't enough.



List Price: $115.00

The Micro-Acoustics 2002-e Cartridge.*

No matter how much you hear about tracking ability, it can't tell you everything about cartridge performance. Because tracking ability only tells how well a stylus stays in the groove on loud passages, at low pressures. Transient ability is just as important. Without it, no cartridge can reproduce music with really lifelike clarity—*because music is mostly transients.*

The problem was, no cartridge offered both. So you had to choose between low record wear (tracking ability) and accurate reproduction (transient ability). Until now.

For the first time, superb transient and tracking ability are available in the *same* cartridge—the Micro-Acoustics 2002-e. Designed by the world's leading manufacturer of record-mastering styli, with direct-coupled electrets and low-mass beryllium stylus bar that offer the most transparent sound your critical ears have ever heard. Tracking at only one gram.

But don't take our word for it. We've prepared a unique demonstration record to help you evaluate and compare cartridge transient and tracking ability. Just send $3.50, and we'll mail you one postpaid. For free information, and the name of your nearest dealer, just write.

ma®

Micro-Acoustics Corporation
8 Westchester Plaza
Elmsford, N.Y. 10523

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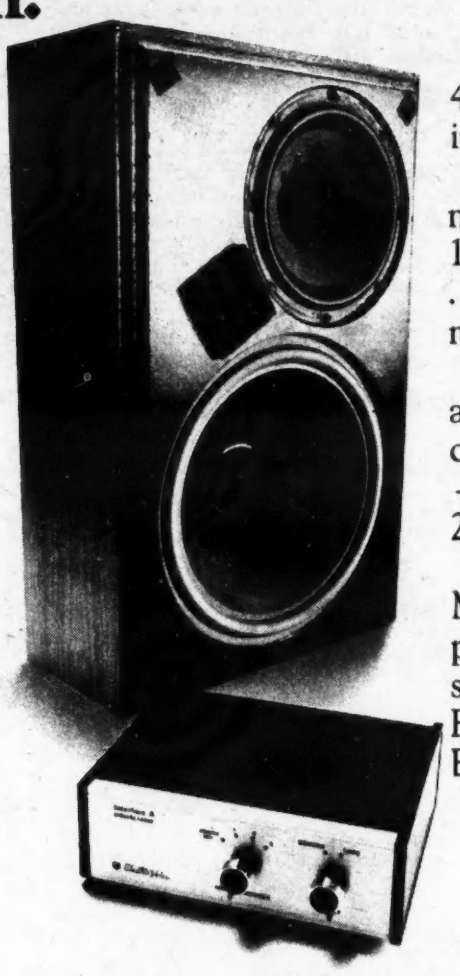
A "noteworthy example of intelligent engineering"[1] that "transcends the commonplace"[2] and "is, simply, a great speaker system."[3]

We couldn't have said it better ourselves.

In our time, the vented, equalized Interface:A has received a small deluge of complimentary reviews from high fidelity magazines. Including the one you're reading.

[1]The *Stereo Review* test, 3/74. "Interface:A can deliver a level of undistorted bass far superior to any other speaker its size we have tested."

[2]The *High Fidelity* test, 2/74. "... unusually flat (plus or minus 1¾ dB from 63 Hz to 15 mHz!) in the omnidirectional measurement."



[3]The *Stereo & Hi-Fi Times* test, 4/75. "... clarity of the bass is most impressive."

The *FM Guide* test, 4/75. "... we measured sound pressure levels of 110 dB during the very loud passages ... the systems handled such musical moments with ease."

The *Sound* test, 2/76. "The on-axis position results in an exceptional curve which is — by speaker standards — virtually flat from 100 Hz out to 20 kHz."

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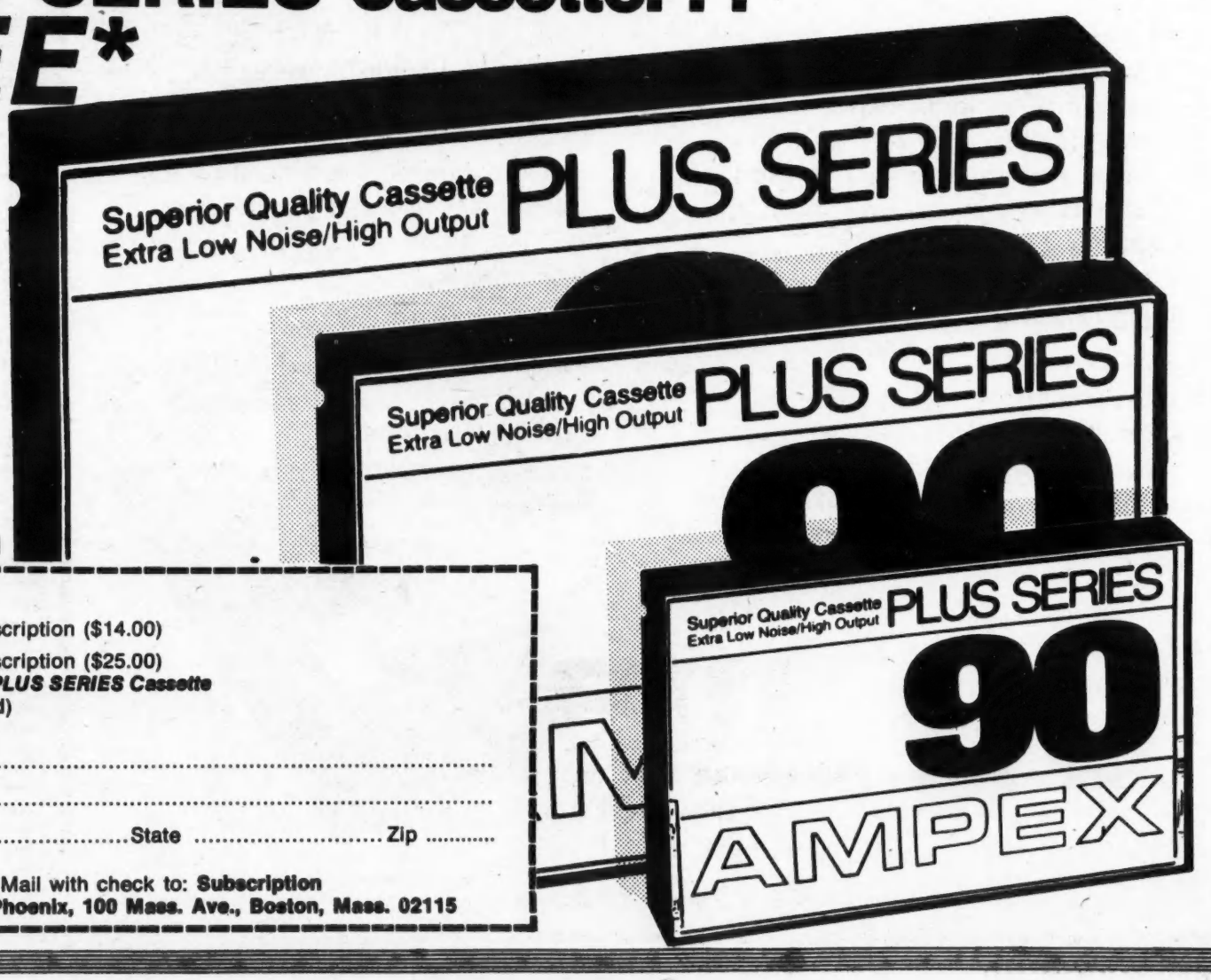

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HISTORY

Continued from page 30

most natural overall tonal balance.

Around this time, in the late '50s, the stereo LP was introduced, completing the second side of the stereo triangle. People could now have stereo without investing in expensive tape equipment for which there was little program material, and the availability of compact, relatively inexpensive acoustic suspension speakers eliminated the need for the large and costly pairs otherwise required for high quality reproduction. The only remaining roadblock to mass acceptance was the absence of stereo radio.

But that, too, was about to change. Daniel Von Recklinghausen, technical director at H.H. Scott of Maynard, Massachusetts, one of the companies that fathered high fidelity and pioneered many innovations in the field (including the transistor, the FET and the integrated circuit), had been working for some time with the FCC, preparing the way for stereo FM. At the same time, he had been preparing Scott. No matter which multiplexing system had been chosen, they would have been ready. Once the decision was made, Scott was first on the market with stereo tuners — tuners that worked correctly (many companies had to recall their first stereo receivers). Recklinghausen personally designed a stereo generator that was used by a number of early stereo stations (including Boston's first, WCRB) and spent many hours helping engineers across the country set up and adjust their own stations' generators. With this final shove, stereophony was on its way.

Photos: Cliff Garboden

Winslow Burhoe (left), and Arthur Janszen

By this time, AR had extended its speaker line, and in 1962 it introduced the AR turntable. As is so often the case with products that come out of Boston, and out of AR in particular, it solved well (and at a reasonable price) problems that had often before and have since been solved poorly at great expense to the consumer. It was well-built, with low rumble, wow and flutter; perhaps most important, it was exceptionally well isolated from shock, vibration and acoustic feedback. Many have since used Villchur's suspension design, but few have used it as successfully. Somewhat later, AR marketed a tuner, an amplifier and a receiver, all highly acclaimed. The tuner, especially, was among the best of its time.

Meanwhile, KLH had moved more and more in the direction of system integration, optimizing the various components to each other to achieve the highest performance for the lowest cost. Their Model Eight table radio used an amplifier and a small speaker matched to one another so as to obtain bass response almost as good as that of the Model Six, though the speaker was only one quarter the size of the Six. The KLH 11, a portable phonograph, was the first consumer high fidelity product to use transistors to miniaturize something. It spawned a series of compact systems, which opened up a new market. KLH also introduced the first all-transistor tuner without serious cross-modulation problems.

Another unusual KLH product was their Model Nine loudspeaker, a full-range electrostatic designed by Arthur Janszen. In a sense, the Nine wasn't a KLH speaker at all. Janszen had worked on it through the '50s and, once convinced of its reliability, he came to KLH for help in producing and selling it. KLH put up the money and the marketing apparatus, thus becoming the angel for what some think is one of the finest speakers ever made.

In 1964, Hofmann and Low pulled out of the company, which was then sold to Singer. The change of management left KLH essentially intact, and innovation continued apace. 1966 saw them working on a project involving a small, plastic tape cassette, similar to the Philips. Only the means of achieving an adequate signal-to-noise ratio eluded them. Around this time, Kloss read Ray Dolby's first article on his new, professional noise reduction system. The next day he flew to London to encourage Dolby to develop a consumer version of his device. As a result, the Dolby B system came into being about two years earlier than it otherwise might have, making its premiere in 1968 in the KLH 40 reel-to-reel tape recorder.

By then, Kloss had had another idea. He suggested to Singer the development of a new kind of television receiver — a wide-screen projection system. They weren't interested, so Kloss left to found Advent in March of 1967.

For two years, the new company worked exclusively on the VideoBeam, until it became apparent that something had to be done to raise some money. Kloss proceeded to design the Large Advent loudspeaker. He followed with the Smaller Advent, then moved the company in a direction that ultimately helped break an entirely new market.

In 1969, Advent began investigating the potential of the Philips cassette. Tape decks were available that used them, but without exception they suffered from some combination of high wow and flutter, weak high frequency response and (especially) poor signal-to-noise ratio. Only a very few machines managed to keep the number of major failings down to one. Advent saw that the technology for curing these ills was already at hand: good tape drives for low wow and flutter, good heads for extended frequency response, and the Dolby B noise reduction system and chromium dioxide tape (known to Advent from their video work), for low noise.

The Advent 200, which they had built to their specifications in Japan, was the first cassette deck to incorporate both Dolby and proper biasing for chromium dioxide tape. It was the first cassette machine to deal effectively with all the medium's problems. Later, Advent replaced it with the 201, which they built themselves in Cambridge. Because no one else would, Advent became the first company to market chromium dioxide cassettes. They also introduced the first separate consumer Dolby unit (the Model 100) and have for some time produced a growing series of very high quality, prerecorded, Dolbyized cassettes on chromium dioxide tape. It is no exaggeration to say that the enormous success of the cassette format, and even of the Dolby B system, is due in large measure to Advent's groundbreaking work.

Dolby is not alone in the noise reduction field, and Boston has certainly been in the forefront of the completion. dbx produces full-band companders for both professional and consumer markets. Their first consumer items, the 117 and the 119, are designed mainly to enhance the dynamics of compressed recording and secondarily for noise reduction in recording. The more re-

Continued on page 40

"A steal." That's what **High Fidelity** magazine told its readers after evaluating the Marantz 5420 Stereo Cassette Deck.

High Fidelity also stressed the two important reasons why the Marantz 5420 is the most exciting stereo cassette deck on the market today: supreme flexibility and incredible performance. Here are some excerpts:

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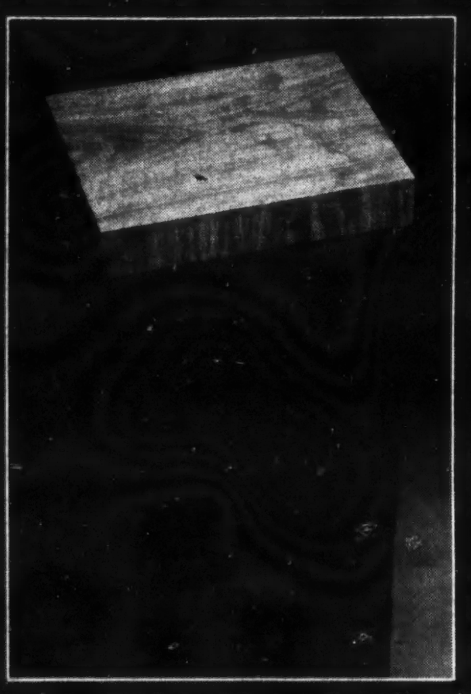
Receiver Savers



These are our least efficient, least powerful speakers—which is to say that they are the most efficient, most powerful you can buy in their price class. The smallest will produce comfortable listening levels with one Watt input, the largest will produce studio listening levels with a 60 Watt receiver—116 dB SPL.

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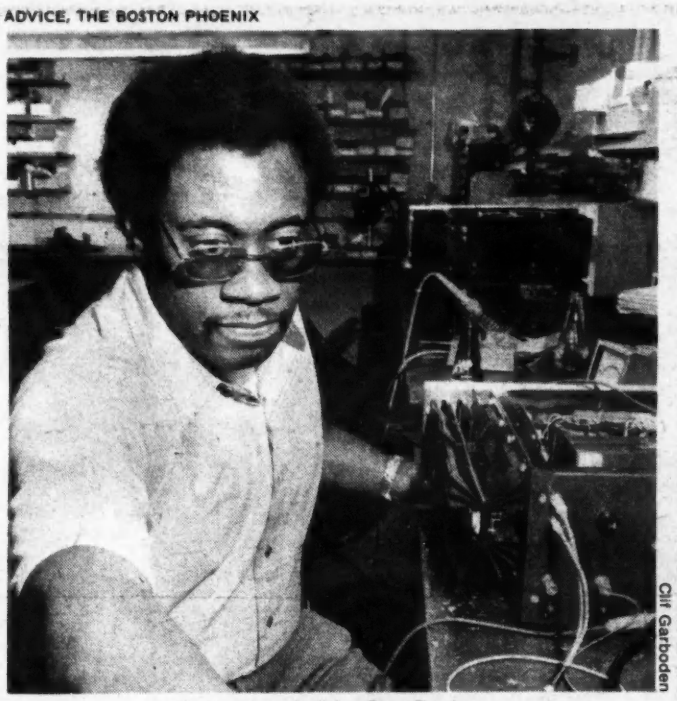
HISTORY

Continued from page 38

cent 150 and 120 series noise reduction systems are intended for use by amateur recordists to provide up to 30 dB of noise suppression and up to 10 dB of additional headroom. As a bonus, the 120 series units will decode dbx encoded discs. dbx will become even more serious competition for Dolby when their circuitry becomes available in consumer tape decks.

Burwen Laboratories' Model 1201 is a noise reduction device of a different stripe — an automatic variable bandpass filter that works on unencoded material to provide up to 14 dB of noise attenuation. The technique used to achieve this is modern in execution but old in conception — being, in fact, very similar to a system used by Scott in the early '50s. Burwen, whose president Richard Burwen is an avid audiophile, also manufactures a high quality preamp, the SP5200, and a novel equalizer, the EQ3200, as well as a variety of professional noise reduction systems.

Another Boston company devoted to electronics was formed (out of a void, almost) only a few years ago by Ron Dunlap and Mel Clarke. Dunlap-Clarke manufactures two high power amplifiers — the Dreadnaught 1000 and the Dreadnaught 500. Both are ruggedly constructed and exhibit almost unmeasurable distortion. The designers place particular emphasis on maintaining utter stability into difficult loads (a sore spot with many amps) and on conservative thermal design to maintain safe operation under difficult conditions.



Cliff Garboden

Super-amp builder Ron Dunlap

Most of the other electronic components coming from Boston are products of companies that started out as speaker manufacturers. The Bose Corporation is a case in point. Amar Bose was a professor at MIT when he did the research that led to the 901 loudspeaker. He found that what mainly distinguishes the concert hall experience from the home listening experience is the dominance of reflected sound in the hall. The 901 attempts to enhance the sense of spaciousness in reproduced music by using a number of small drivers, electronically equalized for good response at the frequency extremes, to bounce most of the sound off the walls of the listening room. Bose introduced the 901 in 1968 and followed its immediate success with a somewhat more conventional, less expensive speaker, the 501, which came on the market in 1970. More recently, they've brought out the little 301 and a high power amplifier, the 1801. As with other Bose products, the design of the 1801 is based upon psychoacoustic research. They have attempted to discover just how good an amplifier has to be to make no audible contribution of its own, the idea being that it's foolish to waste money or to sacrifice reliability for "improvements" that don't really contribute to sonic quality.

The same year the Bose 901 hit the stores, Winslow Burhoe, who had worked for AR and later for KLH, set up shop as Epicure Products, -or EPI, with the avowed intent of making the most accurate speakers for the least money. After weathering a couple of rough years at the beginning, EPI has become a major loudspeaker manufacturer, and recently they've gone on to produce an amplifier and a preamp, the Models One and Two.

Even today, the Boston area is in the vanguard of high fidelity. AR and KLH have introduced new speaker lines. Most of these new speakers employ new drivers, including, in the case of KLH, a new kind of tweeter designed by Daniel Von Recklinghausen that is said to have many of the desirable properties of electrostatics but with much greater power handling capability and efficiency and without the need for a power supply. Roy Allison, who had been with AR since 1959, left in 1972 to start Allison Acoustics. His research into the effects of room boundaries on loudspeaker frequency response led him to design the Allison One and Two speakers to minimize those effects, thereby obtaining smoother bass response than would otherwise be possible.

Recently, Advent has been investigating why phono preamps with essentially identical specifications often sound dramatically different. They've succeeded in finding electrical tests that correlate well with listening tests and have developed design rules which when followed result in preamps that sound both excellent and identical. The first commercial incarnation of this research (which Advent has made completely public) is Advent's Model 300 receiver, but others are following close on its heels. The new Dunlap-Clarke preamp is based on similar principles, and a new company, Davis-Brinton, is making an add-on phono preamp, which the owner uses instead of the poor phono section in his otherwise good amp or receiver.

But the most exciting work going on in Boston is both more fundamental and more far-reaching in its impact. It solves the main problem of ordinary stereo — its inability to do more than just stretch the music out in front of the listener. Stereo as we have come to know it gives little sense of immersion or of acoustic space, and no system that uses only a single pair of speakers can do better.

Until it proved problematic beyond redemption, quadraphony was thought to be the answer. Unfortunately, all the quadraphonic systems required special program material, much of which was poorly recorded and produced additional noise and distortion.

One way out is through time delay. AR and Bolt, Beranek and Newman, a prominent Cambridge consulting firm, have experimented with systems using delayed signals from a stereo source, fed to multiple speakers at the rear and sides of the listening room, to simulate the acoustics of a large hall, which are determined by the ways the hall reflects and absorbs sound. With the right amounts of delay, reverberation and treble attenuation added to the auxiliary channels, ordinary stereo, or even mono, material can sound incredibly lifelike — consistently as good as or better than the best quadraphony, and without its deleterious side effects.

Until recently, such systems had to be very expensive, but now two new Boston companies are becoming the first to exploit advances in digital and IC technology to bring the cost down to the consumer level. The Audio/Pulse Model One uses a new kind of digital encoding process to achieve relatively low cost time delay; the Sound Concepts SD-50 uses a purely analog system built around "bucket brigade" IC's. These remarkably sophisticated devices, which require only the use of an additional amplifier and pair of speakers, sell for about $600 each and are extremely effective. They, and their cousins to come, promise to change high fidelity more than anything else since the beginnings of stereo.

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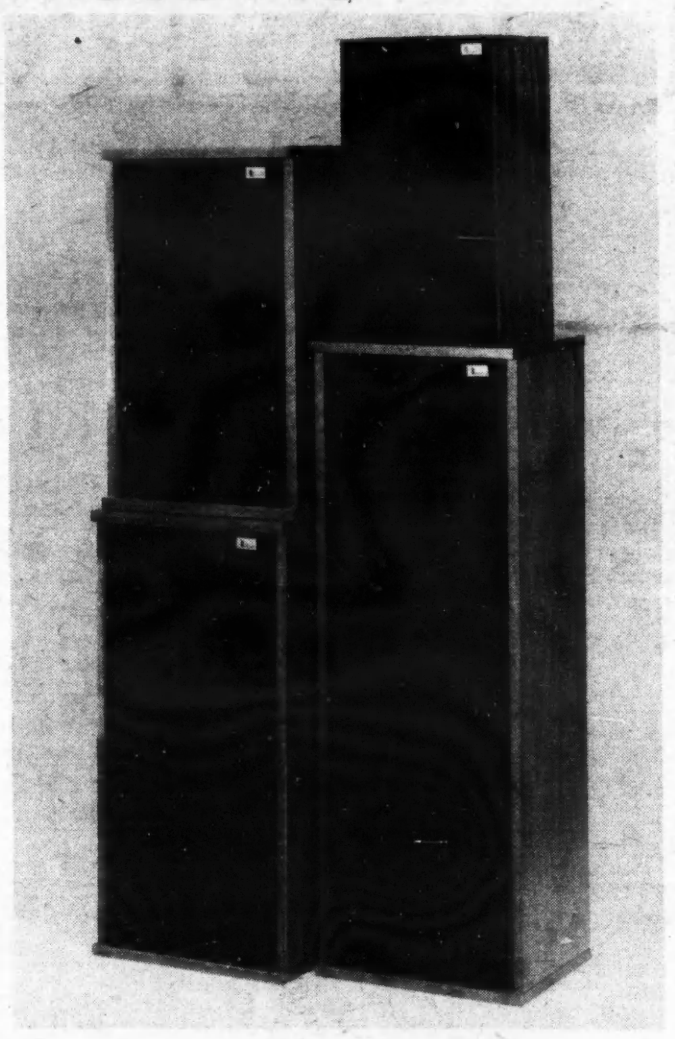

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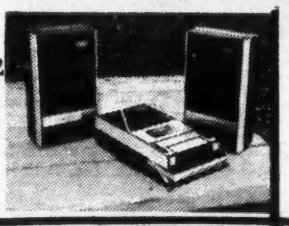

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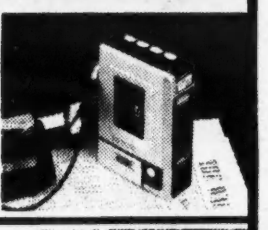

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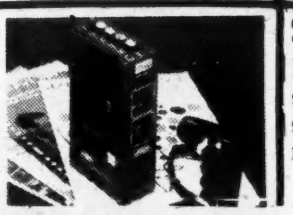

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SPEAKERS

Continued from page 5

purposes, it is safe to assume a standard height of one meter (3.3 feet). Sofas and chairs are usually placed close to or against one wall, and a seated listener's ears will therefore usually be 1.1 feet (13 or 14 inches) away from a wall. Figure 8 shows the calculated effect of the room boundaries on the sound pressure for listeners on a chair or sofa against one wall and at distances from two to seven feet from an intersecting wall. The worst response is displayed, as expected, by the curve for the three-foot side wall distance since it is nearly the same as the height dimension. Also as expected, the shape of the bass peak depends on the distance to the side wall.

Another common sofa arrangement is L-shaped, with the listener seated several feet away from the room wall opposite the speakers. This in effect moves the listener toward the room center, placing him, say, five-and-a-half feet or so from the rear wall. Figure 9 shows the room-boundary effects for listeners seated at distances from two to seven feet from the nearest side wall. It is apparent that these curves are in general rougher than those for positions closer to a wall. The reason is that, with two of the distance dimensions fixed at 3.3 feet (listener height) and 5.5 feet (approximate rear-wall distance), there are not likely to be large differences in the three dimensions. However, the general shape of these curves is not necessarily bad, as we shall see.

The remaining common seating position is in a room corner. If a chair is placed well into the corner, a seated listener's head will be about one-and-a-half feet from each wall, with the result shown by the upper curve in Figure 10. Bad enough. But if a corner chair is used as part of a seating arrangement with a sofa along a wall, it will usually be situated well out from the corner. Then the unfortunate occupant of the chair may find that his head is about three feet distant from each wall. The distance to the floor is almost the same, and when all three dimensions nearly coincide, the result is awful, as can be seen from the middle curve in Figure 10. Minor adjustments in the chair's corner position can be of some help. The lower curve in Figure 10 is for a listener located four feet from one wall and two-and-one-half feet from the other. It can nevertheless be said that corner positions are no more desirable for listeners than they are for conventional box speakers.

Combining positions

If the sound field were perfectly diffuse at low frequencies in your particular listening room (it isn't) and if the room's sound-absorption properties were the same at all frequencies, you could simply add the acoustic power-output curve of your ideal speaker in a given room position to whichever listening-position curve you select, and you would have a precise overall speaker/room/listener response curve. Naturally you would try to find complementary curves, so that the hills in the speaker-output curve would be canceled by valleys in the listening-position curve, and *vice versa*.

There are indeed a few combinations for which this works quite well. Figure 11, for example, shows a curve obtained by simple arithmetical addition of the values from the four-foot speaker spacing curve, Figure 2, and the seven-foot listener-spacing curve, Figure 9. Note that these positions may or may not be practicable in your living room. The amount of bass rise shown is no cause for alarm; it may be about right to balance the bass that gets lost through normal flexing of the room walls.

Another fairly smooth combination, though with considerably more extreme bass, is that shown in Figure 12. This combines the five-foot speaker-spacing curve of Figure 3 with the six-foot listener-spacing curve of Figure 8. Combinations as smooth as these are rare, but they are worth looking for. A combination that might be established by room-decor considerations could produce a curve as bad as that shown in Figure 13, and there are many even worse combinations possible, as inspection of the other curves will prove.

As mentioned, much of the bass rise shown in these curves is not actually heard in most rooms (which is all to the good) because the room boundaries are not sufficiently stiff at low frequencies to retain it all. And also as noted before, rooms of home-listening-room size do not provide diffuse sound fields at low frequencies. Since all loudspeakers are not as inherently flat as our reference standard, does this mean that the curves are useless or unreliable? Not at all. It means that if you use this information to establish the speaker and seating locations *you will be able to reduce the unknown variables significantly* and thereby improve your odds. Even if you ignore the listener-position curves and simply put your speakers where the curves show the room will treat them kindly, you can expect audible improvement.

As is evident, the worst aberrations occur well within the operating ranges of most woofers. Such peaks and dips *cannot* be removed by a speaker's balance adjustments or level controls, but only by changes in a speaker's position. True, some compensation by means of narrow-band equalizers is possible once we know how much boost and cut is needed and precisely where in the frequency range to apply it. But equalizers can also increase amplifier power requirements and speaker distortion. And, in any case, it makes sense to optimize the acoustical situation physically *before* resorting to electronic correction.

It should be noted that *each* speaker system's performance in a stereo setup is determined individually by its position with respect to nearby room surfaces. To the extent that a pair of stereo speakers are producing the same material within the affected frequency range (this is most likely to be true in the bass region), it may be possible to achieve partial compensation of power-response aberrations by choosing appropriate differences in position for the two speaker systems. It can certainly be said that the most uniform power output will *not* be obtained from a pair of conventional stereo speaker systems if they are placed symmetrically in a room, for in such a situation each system will have the same aberrations.

What all these investigations make clear, of course, is that we need speaker systems whose woofers will be uniformly loaded by a room throughout their assigned frequency range without being unduly influenced by their position in the room. It is perfectly feasible to design systems of that kind — some, in fact, are now being made. But until there are more of them available, we can help the standard speaker boxes provide better sound simply by being careful where we put them — and our listening selves.

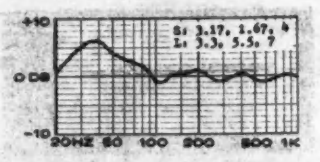


Fig. 11. In some cases, a conventional speaker system can be so located that its output curve is complementary to the boundary augmentation at a given listener position. The room/listener curve is obtained by adding the power output of the standard box in position 3.17, 1.67, 4 (Fig. 2) to the listener-position curve 3.3, 5.5, 7 (Fig. 9).

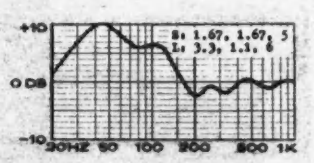


Fig. 12. Another room/listener curve, relatively smooth but with strong bass. Speaker-output curve 1.67, 1.67, 5 (Fig. 3) was added to listener-position curve 3.3, 1.1, 6 (Fig. 8).

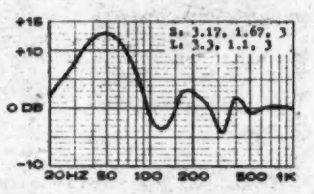
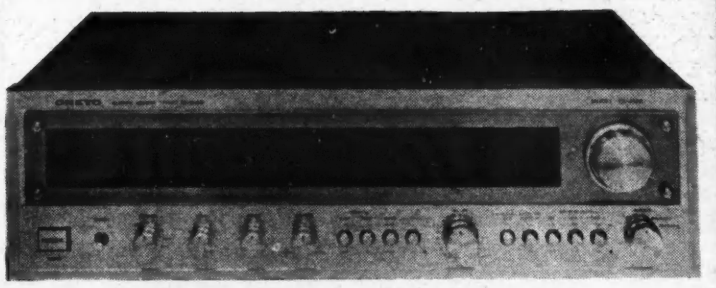


Fig. 13. A room/listener curve that might be obtained by addition of random but typical speaker and listener-position curves. There are many worse combinations.



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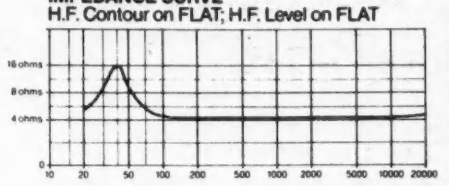
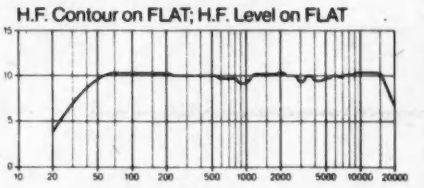
IMPEDANCE CURVE
H.F. Contour on FLAT; H.F. Level on FLAT



FREQUENCY RESPONSES
Q adjustment in .6 position
H.F. Contour on FLAT; H.F. Level on FLAT



Power Plus.

The Scott R336 Receiver.

Power is important. But power alone is not enough. That's why the popular Scott R336 gives you all the power you need. Plus the performance features you expect.

The Scott R336 provides 42 watts minimum continuous RMS power output per channel. More than enough for most listeners. And both channels are driven into 8 ohms from 20 Hz to 20 kHz with no more than 0.3% total harmonic distortion.

Power? Sure. But check these important performance features many other receivers in this medium price range have sacrificed.

IM distortion (lower than 0.15%). Far below the average. Provides cleaner sound and eliminates listening fatigue.

Signal strength and center channel tuning meters. Provide simultaneous visual indication of correct tuning and optimum signal strength.

Phase locked loop multiplex section. Maintains superior stereo separation. Remains in alignment for the life of the receiver.

FET RF stage. Assures higher sensitivity and overload immunity.

Log-linear taper volume control with detents. Spreads out volume levels. Provides finer control at low-to-moderate levels.

Clutched bass and treble controls with detents. Allow altering the frequency response of one channel without affecting the other. Systems can be "custom balanced" to compensate for room acoustics, decor or speaker placement.

Separate high-frequency noise filter. Permits cleaning up of noisy tapes, discs or broadcasts.

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Two completely independent tape monitors. Allow two tape recorders to be used simultaneously for direct tape-to-tape copying without passing through the receiver's electronics.

FM Muting. Silences interstation hiss while the tuner scans the frequency spectrum.

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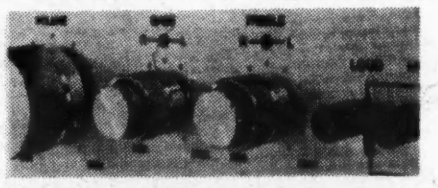
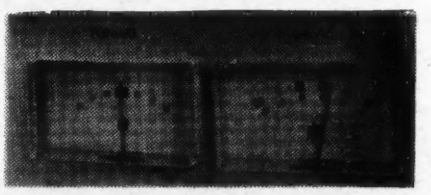
Over 120 db IF gain. Assures better limiting and better AM rejection.

Instantaneous electronic protection circuit in the output stage. Employs voltage/current sensing to prevent output transistor failure and speaker damage.

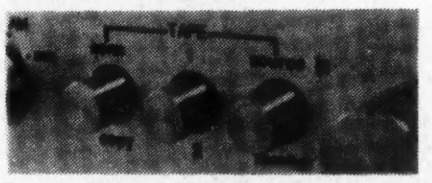
AM section designed around a tuned RF amplifier using J-FET. Improves signal-to-noise ratio.



Clutched bass and treble controls with detents.



Signal strength and center channel tuning meters.



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And the Scott R336 is backed by a three-year, parts and labor limited warranty. Another very important plus.

For specifications on our complete line of audio components, write or call H.H. Scott, Inc. Corporate Headquarters: 20 Commerce Way, Woburn, MA 01801, (617) 933-8800. In Canada: Paco Electronics, Ltd., 45 Stinson Street, Montreal, H4N2E1, Canada. In Europe: Syma International S.A., 419 avenue Louise, Brussels, Belgium.

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MAGAZINES

Continued from page 6

these latter duplicate those in *SR*, but many don't or are blunter and more detailed.

High Fidelity

Celebrating its 25th anniversary with a circulation of about 310,000, this monthly has a very different editorial profile from *SR*'s. It is aimed less at the beginner, more at the established listener who is already well-started on his record collection and has already been through the experience of his first component system. *HF*'s readers are assumed to have a mature and continuing interest in equipment and recording, with no need to be seduced by the sort of lightweight feature pieces on musical personalities to which *SR* devotes space. This attitude extends also to the physical production of the magazine, which is less glossy and colorful than *SR*, and even to the typeface, which is less attractive and easy to read than *SR*'s.

What most people buy (and save) *High Fidelity* for is its record reviews. By comparison, the reviews in SR often are too brief, and occasionally are downright irresponsible. *HF*'s record reviews, especially of classical music, are longer, more thorough and analytical, and more authoritative than those in any other major American magazine (though of course a few exceptions can always be found to such a generalization). The classical critics number some two dozen. Of course, readers who are just beginning to appreciate classical music may find *HF*'s reviews a heavy diet to digest.

Incidentally, whereas *SR* gives pop and classical music equal play (and angered many subscribers a few years ago by moving the pop reviews to the featured position in the magazine, relegating classical records to the back pages), *HF* is plainly committed to classical music. A typical issue may contain 20 pages of reviews of the classics, four pages of pop and two of jazz. This orientation is even stronger in the optional "Musical America" edition of *HF*, which includes a 40-page inserted supplement on the nationwide concert activities of classical musicians, with some dance coverage.

Just as *High Fidelity*'s music reviews are better suited to experienced record collectors than to beginners, *HF*'s equipment reviews are aimed at knowledgeable audiophiles rather than novices. Technical freaks like *HF*'s reviews because they include more performance measurements than other magazines print. Unfortunately for most readers, this mass of data is presented in largely undigested form, leaving it mostly up to the reader to decide whether the reported performance measurements represent desirable behavior or not.

Actually, this criticism applies more to what *HF*'s reviews have been than to what they are becoming, for the quality of the technical writing is in transition. For several years it was appallingly uninformed and misleading; misinterpretations of measurements were commonplace, as was the publication of useless data. However, the technical editors now in charge have been making a very visible effort to upgrade the accuracy and usefulness of the equipment reviews and the other technical writing in the magazine, and it is paying off. The texts of reviews provide much more interpretative assistance for the non-engineer reader than was formerly the case, and gross misinterpretations of the meaning of measurements are becoming rare. There is still room for improvement (for instance, *HF* seldom reminds readers that its anechoic-chamber loudspeaker response curves show very different bass performance from what the tested speaker will exhibit in a room with normal walls). But technical editor Robert Long and his associates have shown an admirable readiness to learn and to find better ways of measuring, interpreting, and expressing technical performance data. For instance, *HF* was the first to adopt the decibel (dBW) method of expressing amplifier power output as I recommended in the *Phoenix* HiFi supplement of one year ago. If the rest of the industry will follow *HF*'s lead, consumers will be much less susceptible to incorrect notions about the relationship between amplifier power and audible performance.

Radio Electronics

This magazine really doesn't belong here either, as most of its 180,000 circulation is among TV service technicians and the like. But recently *R-E* started publishing detailed test reports on audio components (prepared by Len Feldman, a prolific audio writer), plus occasional feature articles describing the internal circuitry of new components. Recommended primarily for experienced audiophiles. No music reviews.

Audio

Try to imagine a magazine which is the exact opposite of *Stereo Review* and you have the monthly *Audio* (circulation about 110,000). Where *SR* is very tightly edited to achieve a uniform style and philosophy, *Audio* is hardly edited at all; it is a nearly random collection of writings by authors with wildly varying personal styles and varying degrees of competence. No visible effort is made to massage the magazine into a coherent whole. Its record reviews, for the most part, are a joke — to be read for entertainment only.

Where *SR*'s content is tailored to broaden the understanding of the novice audiophile (and carefully minimizes the incidence of technical errors and ambiguities), *Audio*'s contents don't seem to be aimed at any identifiable readership. A typical issue will have question-and-answer columns handling inquiries that could only come from the least-informed novice (and the magazine's answers vary from being right on target to being totally wrong). The same issue of *Audio* will contain a feature article and a loudspeaker review which are comprehensible to only a few professional engineers. With this confusion of goals, *Audio* is neither a trustworthy consumer-guidance magazine nor a satisfactory engineering journal.

But it *is* popular, especially among advanced audiophiles — doubtless because among its odd assortment of features, *Audio* contains elements which are often interesting and sometimes provocative. For example, Bert Whyte's sometimes puffy column often discusses new developments in audio components months before they reach the stores, and E.T. Canby's

Continued on page 46

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The sound of Cizek. A brave new world in loudspeaker technology.

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MAGAZINES

Continued from page 44

musings on recorded sound and new classical releases can be entertaining in their odd syntax even if what he says is boring or infuriating.

The core of the magazine, of course, is its test reports, which are much longer than those in the other large-circulation magazines, with lots of commentary as well as plenty of measurements. Test reports on middle-of-the-road receivers are handled adequately by Len Feldman. But reviews of top-of-the-line preamps and amplifiers have become the specialty of Bascom King, who evidently is a "golden-ears" audiophile capable of hearing clearly those subtle differences among amplifiers which most listeners either can't hear or have not learned how to listen for. He succeeds in identifying audible imperfections in nearly everything. His reviews have a somewhat experimental flavor, as they include (in addition to standard tests) measurements whose correlation with subjective sound quality is as yet unestablished. Thus the reviews make good reading for audiophiles interested in exploring this important and expanding frontier — the relationship of test data to the subjective quality of audio components.

This trend is carried further by loudspeaker reviewer Richard Heyser, whom most audiophiles (and some loudspeaker designers) confess they don't understand. The key to interpreting Heyser's thickly written reviews is to remember that, whereas many speaker designers assume that the most important sonic parameter of a loudspeaker is the frequency-response curve characterizing the total acoustic power which the speaker produces, Heyser is operating on the assumption that the important aspect of a speaker is its behavior on very brief transient sounds. His tests are made by feeding an ultrashort transient sound (click) to the speaker, picking up the resulting sound with a microphone, and using a computer to analyze the sound as it leaves the speaker (but before it can interact with the listening room at all). The resulting graphs, if they can be deciphered by the reader, do indeed reveal an aspect of loudspeaker performance that other reviewers ignore. But Heyser's data describe only one aspect of speaker performance and should not be relied on to provide the basis for either selecting or rejecting a speaker. Other aspects of performance (such as dispersion at various frequencies and overall octave-to-octave tonal balance as heard in a normal listening room) may prove to be more important to your ears.

Others

We have looked at the six largest commercial monthlies, but there are many other audio magazines which deserve equally close examination. Lacking room to explore them all in detail here, we can at least list some.

Modern Hi-Fi and Music: Despite the title, it is mostly about pop music; its hi-fi coverage is rather skimpy.

Modern Recording: Bi-monthly; interviews with record producers and engineers, behind-the-scenes looks at recording activities (a recent issue described how the Boston Symphony's Tanglewood broadcasts are done but with no mention of how the excessively distant microphone placement was arrived at), and a heavy emphasis on semi-pro recording equipment.

Hi-Fi/Stereo Buyers' Guide: Bi-monthly; about 40 short, once-over-lightly test reports per issue, seldom critical; plus feature articles which are beginner-oriented in tone and variable in quality.

Stereo: Quarterly; used to contain only reprints from *High Fidelity*, but lately has acquired a separate identity. Each issue is organized around a theme; the latest issue is about amplifier power, with a thorough catalog of all of the available amplifiers. The test reports are cogent, and their complexity is scaled to the price level of the product — budget-class products receiving clear, novice-oriented reviews while top-class audiophile products get long data-filled texts.

Tape Deck Quarterly: Just what the title says. Not for advanced audiophiles, but a notch or two above novice level. Discussions of cassette machines, other tape formats, blank tape, accessories, and pre-recorded tapes.

Sound Wave: Quarterly; the newest commercial audio magazine, with a unique slant — it is sold mainly through audio dealers rather than on newsstands. The first issue is now in Atlantis stores and may reach other store chains later. No test reports, no record reviews, just feature articles (on equipment, on musical personalities, on video and film sound, on the hearing sensitivity of men *vs.* women, on new products), plus news items.

By mail only

And then there are all of the special audiophile publications available only by mail subscription — *Stereophile, Absolute Sound, Sound Advice, Stereopus, Audiogram, BAS Speaker, Audio Amateur*, etc., etc. We'll get to them in a future supplement. Meantime, happy reading!

HUM-MMM

Continued from page 11

wire's sensitivity as an antenna. But to be fully effective the cable's shield must be grounded where it connects to your amplifier (or other component). The standard RCA phono plug which is used on most audio cables contains two metal parts: a protruding central probe (which is inserted into the socket and carries the musical signal) and a surrounding skirt (which is connected to the cable's shield and must have a low-resistance grip on the exterior part of the socket when plugged in). So to reduce the pickup of hum and radio interference in cables, check every plug to be sure that its metal skirt makes a snug fit on the socket it is connected to. Pinch or crimp the skirt slightly if necessary to get a tight fit.

The socket itself is a potential source of difficulty. The metal exterior of the socket may become oxidized and corroded after a year or two, preventing the plug's skirt from making a good low-resistance, metal-to-metal contact with the socket. The phono plugs on some cables are designed to combat this problem; they have a precisely made, very stiff skirt which scrapes away the corrosion or oxide on the socket when plugged in. But the skirts on most plugs are too flexible for this. So if you want to minimize weak traces of hum and radio interference, polish the exterior surface of every phono plug once a year, using a rubber pencil eraser — or, for serious corrosion, a fine grade of steel wool.

The purpose of such polishing is to ensure that the cable's shield has a low-resistance path to ground. Unfortunately the cable itself may develop high resistance as time goes by, most commonly at either end where the phono plug is molded onto the cable. It is a mistake to think that audio cables will last as long as the equipment they are plugged into. Ideally it would be wise to test every cable annually with an ohmmeter, measuring end-to-end resistance and replacing any cable exhibiting more than a few ohms of resistance. If this is impractical, at least be aware of the possibility that hum in your system could be due to a defective $2 cable.

Of course, even when every cable shield is securely grounded through the phono sockets, it isn't really "grounded" unless the amplifier itself is connected to a true earth ground. There may be exceptions to this rule, but I have never encountered a case of system hum which wasn't lowered by correctly grounding the system. Usually this means connecting a wire from the amplifier's ground lug to either 1) a banana plug inserted into the third hole of a three-wire electrical outlet, 2) a clamp on a cold-water pipe, or 3) a clamp on a steam radiator.

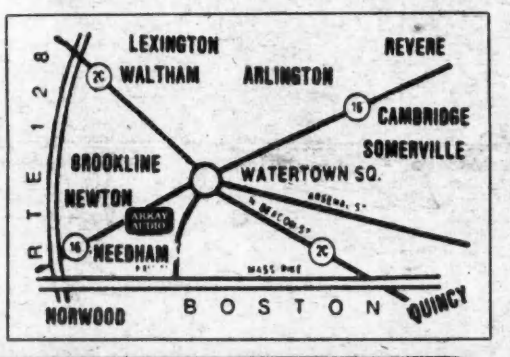
Incidentally, if you have your audio components installed on racks of steel shelving, the rack can act as a 60 Hz antenna, focusing the hum field from your house wiring onto your equipment. So it is useful to scrape off the paint from an inconspicuous spot on the rack, and install a bolt or clamp from which a wire can be run to ground.

Taken together, all of these suggestions represent a lot of bother; they might take up most of a weekend which could be more pleasurably spent. But if you have audible hum in your system — even if only at a low level — a 10 dB reduction in the hum level may provide a greater and more satisfying improvement in the transparent clarity of the subtle details in good recordings than would the purchase of an expensive new low-distortion amplifier.

Our Customers Know They're the Best.

because at Arkay Audio we make the time to treat them the best. Arkay offers personal service, advice geared to your needs — not how much money we can wring out of you. We will order any piece of equipment you need and then service it for you at the store!

Our customers know they're the best — And we know they want to buy the best. and THAT'S why they come to ARKAY!



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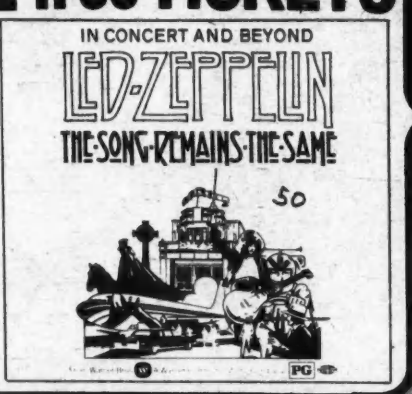

SONY CASSETTE SALE!

MAKE YOUR OWN MUSIC

Make concert quality tapes for your car or your home, tape lectures at school, tape your favorite radio program, with SONY Blank tape.

Play it for keeps with a Sony.

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CASSETTES

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hope to be invited into the palace. I mean, you can't have much of a ball with tapes that are hissing at you all the time.

But that meant two "extra" switches on all high fidelity cassette decks. And it also meant that some extra care had to be taken if these switches were to do their jobs properly. In particular, the Dolby circuit is as fussy as a palace protocol officer about things being just so. If the deck's frequency response is off, Dolby will magnify the departure from the ideal flat characteristic. And if the Dolby is off itself, it will introduce departures from flat where none existed before. So if the noise reduction is not to exact a penalty, the design rulebooks must be obeyed.

That was hard to do with tapes changing all the time. Some of the magic oxide brews being stirred up in the cauldrons of various fairy godmothers in St. Paul, Ludwigshafen and Tokyo produced high-output tapes. Others produced tapes with extra high-frequency sensitivity. Extra output throws off the Dolby alignment unless it is compensated for. Extra high-frequency sensitivity throws out the frequency response unless an adjustment is made for it in bias current or recording equalization or both.

To take care of such things, little screws for adjusting the Dolby reference level and little switches for adjusting ferric bias (in addition to the position needed for chrome) started to appear on cassette decks. By now the transport deck — the coach, so to speak — was getting fairly ornate with extra switches. And some decks also had a switch to convert VU meters into peak-reading ones in the interest of displaying more accurately the actual instantaneous maximum signal levels that the tape was being asked to cope with.

There's nothing wrong with all these added features. They're far more than just curlicues in the design; they all contribute materially to the precision with which recording and playback can be accomplished.

Precision is, in fact, the magic that converted this Cinderella into the princess of home recording. And not just electrical precision: dozens of refinements went into the mechanics of both the transport and the cassette itself. New plastics and molds made cassette shells more precisely dimensioned, more rigid (and hence more stable and jamproof in use), and less subject to thermal deformation. New slitting techniques made the tape itself more precise, while new assembly techniques kept the parts through and over which the tape must pass more precise. Dual-capstan drive, servo and synchronous motors, and refined mechanical construction kept the tape moving at a steadier pace. Precision.

Decked out as she is, the Cinderella cassette has made a hit where it really counts: in the marketplace. The fairy godmothers have a right to be proud of their work; but unfortunately they have a tendency to sit back, gossiping, and let their cauldrons boil over. If they're not careful they may get so engrossed in self-congratulation that they wreck the whole enterprise. Somebody's got to keep an eye on that inexorable clock.

One manufacturer, for example, came out with a tape a few years ago that, it claimed, would "improve the performance of any cassette recorder" but would yield its best results (as you found out if you read the fine print) only if the recorder was readjusted for it. What, exactly, did this mean?

A little investigation proved that it meant exaggeration. While the tape was a genuine improvement over the formulations generally available at the time, it required a little more bias than standard tapes if it was to give the flat frequency response that is required of *any* really good performance. Without that increase in bias the sound would be a little heavy on the high frequencies. That is, the response curve would have a little peak near the top of its useful range.

How could this be called an "improvement" over conventional tapes, since peaks are, by definition, undesirable response characteristics? Simply because many decks were somewhat wanting in that extreme of the response range, and the new tape might be said to "make up" for this deficiency. So the manufacturer's come-on represented a sort of half-truth.

Such statements continue to appear in advertising and even in what purports to be technical literature — and not by any means from just this one manufacturer. And the half-truth is even less defensible today — when improvements in head design, for example, have reduced or eliminated the "deficiency" that such underbiasing might be said to "correct" — than they were when the tape in question was new.

Several other tape companies currently are ringing a change on this tune. They show superimposed response curves (usually elegantly contoured affairs that bear only a passing resemblance to the real-world curves that come out on a test-bench chart recorder) for two or more tapes in which the "best" tape is shown with this type of peak toward the high end. As you read the blurb you get the distinct impression that the peak is good — that it is, in fact, the index of the tape's superiority. If you understand that the tape *can* be better, but only once the deck is adjusted to remove the peak, you're okay. The trouble is that most readers probably don't understand this and therefore conclude that they should be looking for a tape/deck combination with peaky high-end response.

Similarly, there's the matter of tape sensitivity. Some of the ads come on as though the higher the sensitivity, the better the tape. In theory, there's some sense to this notion; in practice there isn't, unless you're not using Dolby or you can adjust your Dolby circuit for sensitivity that's higher than your deck is manufactured to handle.

Sensitivity is simply a measure of the ratio between output signal levels and input signal levels. If one tape has 3 dB more sensitivity than another, you'll get 3 dB more signal off of it for a given input; but if your Dolby reference level is set for the lower-output tape, the Dolby decoder will make incorrect "decisions" about what it should do to the recorded signals. For most purposes the imprecision of the result may be undetectable or only barely detectable. But again, anything that threatens the precision that has made the cassette what it is threatens to undo all that has been done.

Deck manufacturers, too, play fast and loose with our Cinderella. They seldom tell you waht specific tapes you should use to achieve the quality built into your equipment — and to realize the specs on the basis of which you've bought their deck which, we're told, legally constitute part of your implied warranty. This is like an automobile manufacturer browbeating you with horsepower numbers and then, once you've bought his chariot, refusing to divulge what gas you need to keep the horses going at the specified efficiency.

The deck manufacturer may tell you there's nothing comparable to octane ratings for tape formulations. How is he to specify what kind you should use? By giving you brand and type, that's how. And not by listing every brand on the market and implying that all will work equally well. They won't.

Deck manufacturers, too, may give the impression that a high-frequency peak in the response is a good thing. It's nice for advertising because it squeaks a slightly higher number out of the top end of the response spec by contrast to the same tape and deck, correctly adjusted to remove the peak. It's nice for the floor salesman because it's an audio truism that "brighter sounds better" and a deck with a slight peak may sound a little zingier than one that's flat.

But it's not good for the home user for two reasons. First, while a little extra zinginess may sound fine on a noisy sales floor, it can get to you in long hours of home listening as it exaggerates sibilants in speech and the more metallic sounds in music — and harmonic distortion that may already be in the signal. Second, by being imprecise — and adding to other imprecisions that, intentionally or otherwise, have been introduced into your deck/tape combination — it's helping to undermine the medium.

Don't get me wrong: there's no cause for panic — yet. Cinderella's still waltzing around the dance floor with only a hair out of place here and there. But under the music I think I hear a clock tolling. Those fairy godmothers had better get on the stick before the cassette starts a nosedive toward the biggest pumpkin since the Hiss trial.

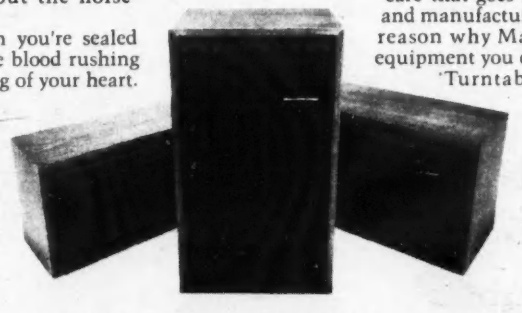
Sealed in this room, you can actually hear the blood rushing through your body.

The Marantz anechoic* chamber. A totally soundproof room where insulated wedges 4 feet deep soak up every whisper. Where a "floor" of criss-crossed steel wires absorbs jolts and bumps. Where reinforced concrete walls, standing apart from the surrounding structure, completely isolate the chamber and shut out the noise of the world.

It's so eerily quiet that when you're sealed inside you can actually hear the blood rushing through your body. The pounding of your heart.

We built this remarkable room to evaluate performance characteristics of Marantz speaker designs. It's acoustically ideal—devoid of all sound waves but those pouring directly from the speaker being tested. And that testing is the most rigorous, scientifically exacting examination to which any speaker prototype can possibly be subjected. Only when we're completely satisfied with Marantz speakers in our laboratory, are we willing to let you listen to them in your living room.

The anechoic chamber. One example of the painstaking care that goes into every detail of every design and manufacture of every Marantz product. One reason why Marantz makes the finest stereo equipment you can buy. Receivers. Components. Turntables. Cassette tape decks. And speakers. Listen and decide for yourself. At your nearest Marantz dealer. He's in the Yellow Pages.



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We sound better.

*ana-kōik: free from echoes and reverberations. ©1976 Marantz Co., Inc., a subsidiary of Superscope, Inc., 20525 Nordhoff St., Chatsworth, CA 91311.

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The Hifi Show Is In Town.

See all the major brands, all in one place.

At Tech Hifi you'll see the new 1977 models from all the major manufacturers. We display and stock more name-brand components than any ordinary store (over 100 lines in all). Afterall, Tech Hifi *is* the Hifi Show.

You never have to compromise at Tech Hifi because we have *exactly* what you want. And we have soundroom facilities that make it possible to compare any combination of components, just by pushing a button. Afterall, you'd expect ideal listening conditions at The Hifi Show!

Listen to the difference between "stereo" and "hifi".

Many people make the mistake of buying a "stereo" compact system, when they really wanted "hifi."

"Stereo" is a term that is used to describe *anything* that reproduces sound through two channels. So even the plastic compacts that drug stores sell are called "stereo". But they are far from high fidelity.

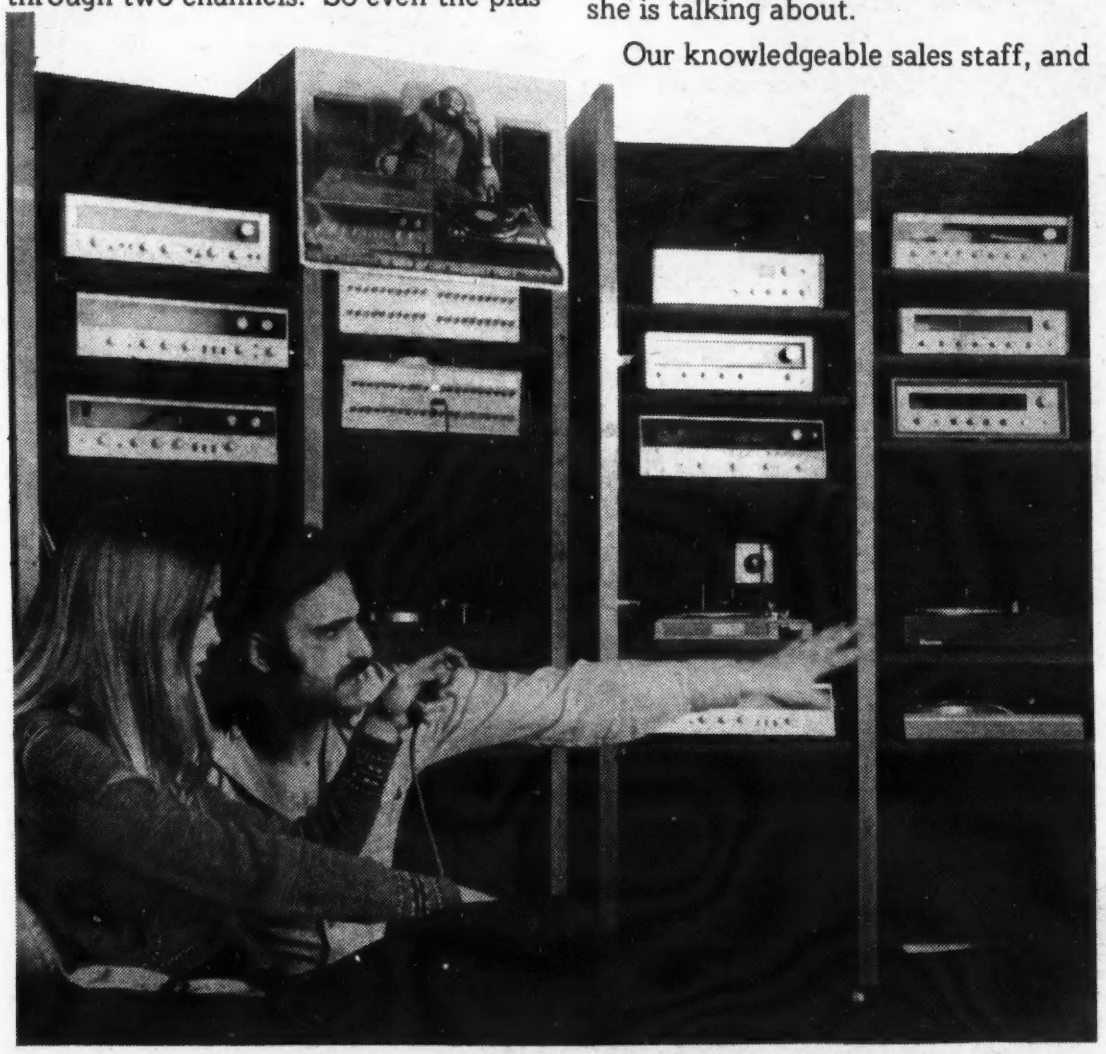
"Hifi" refers to the ability of components to *faithfully* reproduce sound. Very few stereo compacts are capable of true high fidelity (not even those that cost as much as $200 - the price at which the systems at Tech Hifi start).

You'll be able to *hear* the difference at The Hifi Show. You'll also see that hifi doesn't mean "high finance". A decent hifi system can cost you less than many lo-fi compacts and consoles!

Talk to high fidelity experts, not high pressure salesmen.

Since we want you to think of Tech Hifi as The Hifi Show, our salespeople believe in taking the time to explain things. And everybody at Tech is specially-trained to explain hifi simply, in English. The salesperson you meet at The Hifi Show will *know* what he or she is talking about.

Our knowledgeable sales staff, and personal approach to selling hifi, are fundamental differences between Tech Hifi and other stores.



2,000,000 people have enjoyed The Hifi Show.

The first Tech Hifi store opened ten years ago. It was started by two students at M.I.T. who recognized a need for an audio store that carries all the name brands, and offers good discounts.

In a decade, Tech Hifi has grown to 48 stores throughout nine states. The result of such growth (in addition to providing two former M.I.T. students with a nice standard of living) is that Tech Hifi now has tremendous buying power, enabling us to offer sizeable discounts on all brand-name components.

Before you buy hifi for college, learn about it at The Hifi Show.

In about a half hour's time at The Hifi Show, you'll learn just about everything you need to know about hifi to enjoy it.

For example, if you want a hifi system for your bare-floored, cinder-blocked not-so-roomy college room - the experts at Tech Hifi will help you figure out how to balance power specs and loudspeaker efficiency to end up with the right combination of components for you. They'll also fill you in on the kind of FM specs you'll need for your dorm location, and what control and convenience features are most important. And at the Hifi Show, you'll always have the opportunity to audition any combinations of components in our soundrooms, so you'll know exactly how they sound.

240A Newbury St., 870 Commonwealth Ave., **BOSTON** / 38 Boylston St., 182 Massachusetts Ave., **CAMBRIDGE** / Route 9, **FRAMINGHAM** / Route 1, **DEDHAM** / 835 Southern Artery, **QUINCY** / 352 Main St., **STONEHAM** / 279 Main St., **WORCESTER** / 259 Triangle St., **AMHERST** / 186 Main St., **NORTHAMPTON** / Hanover Plaza, **Hanover** / 375 North Montello St., (Route 28) **BROCKTON** / Rt. 1 Northbound, Augustine Plaza, **SAUGUS** / Main St., **HANOVER, N.H.** / Nashua Mall Extension, **Nashua, N.H.** / **The Service Center:** 870 Commonwealth Ave., **BOSTON** / **The Bargain Center:** 667 Main St., **WALTHAM** / Stores also in Rhode Island, Connecticut, Vermont, New York, New Jersey, Ohio, Pennsylvania and Michigan.